US Army Corps
of Engineers
New England Division

Feasibility Report
Water Resources Development
Connecticut/New York

September 1984

Rippowam River Basin

RIPPOWAM RIVER BASIN

CONNECTICUT AND NEW YORK

FEASIBILITY REPORT

FOR

WATER RESOURCES DEVELOPMENT

DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASSACHUSETTS 02254

SEPTEMBER 1984

SYLLABUS

This Feasibility Report includes the results of a water resources study initiated in response to a Congressional resolution of October 1974. A separate Detailed Project Report, Local Flood Protection, Rippowam River, Stamford, Conn. recommends that local flood protection be constructed under the special continuing authority contained in Section 205 of the 1948 Flood Control Act, as amended.

The Rippowam River Basin is located in southeastern New York and southwestern Connecticut. The 37.5 square mile drainage basin begins in Ridgefield, Connecticut and empties into Long Island Sound at Stamford, Connecticut. After passing through about 19 miles of suburban and rural areas the river enters the highly urbanized center of Stamford for the last two miles before reaching Long Island Sound. It is in this highly urbanized area where in October 1955, June 1972 and during other flood events that extensive damages have occurred to primarily commercial and residential structures and their contents. Nuisance type flooding threatens low lying areas of the flood plain on an almost annual basis.

A full range of both structural and non-structural solutions to the flood problems were investigated. Of the alternatives investigated only measures located within the lower two miles of the Rippowam River were found to be economically feasible. The cost of the selected plan fell within the limitations of the special Continuing Authority program (Section 205) and will be recommended in a detailed project report which is currently under final preparation. The city of Stamford has provided a letter of intent supporting the selected plan.

RIPPOWAM RIVER BASIN
FEASIBILITY REPORT
FOR WATER RESOURCES DVELOPMENT
CONNECTICUT AND NEW YORK

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INTRODUCTION

The Rippowam River Basin is located in southeastern New York and southwestern Connecticut. The 37.5 square mile drainage basin originates in Ridgefield, Connecticut and empties into the Long Island Sound at Stamford, Connecticut (See Figure 1). Because of repeated flooding events in the basin, primarily in Stamford, Connecticut local officials requested Federal assistance. A study to determine the feasibility of providing flood protection was begun in 1976.

STUDY AUTHORITY

Because of the almost yearly flooding being experienced in various widely scattered sections of the highly urbanized area of Stamford, and because of the threat of more flooding due to urban expansion, the Committee on Public Works of the House of Representatives, at the request of local interests, adopted a resolution on 10 October 1974 requesting a study of the flood and associated water resource problems in the Rippowam River Basin.

"Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report on Land and Water Resources of the New England-New York Region, transmitted to the President of the United States by the Secretary of the Army on 27 April 1956, and subsequently published as Senate Document Number 14, Eighty-fifth Congress, with a veiw to determining in the light of the heavy damages suffered during the storm of June 1972, in Northeastern United States, the advisability of improvements, particularly in the Rippowam River Basin in the vicinity of Stamford, Connecticut, in the interest of flood control, navigation, water supply, water quality control, recreation, low flow augmentation, and other allied water uses in this heavily urbanized area."

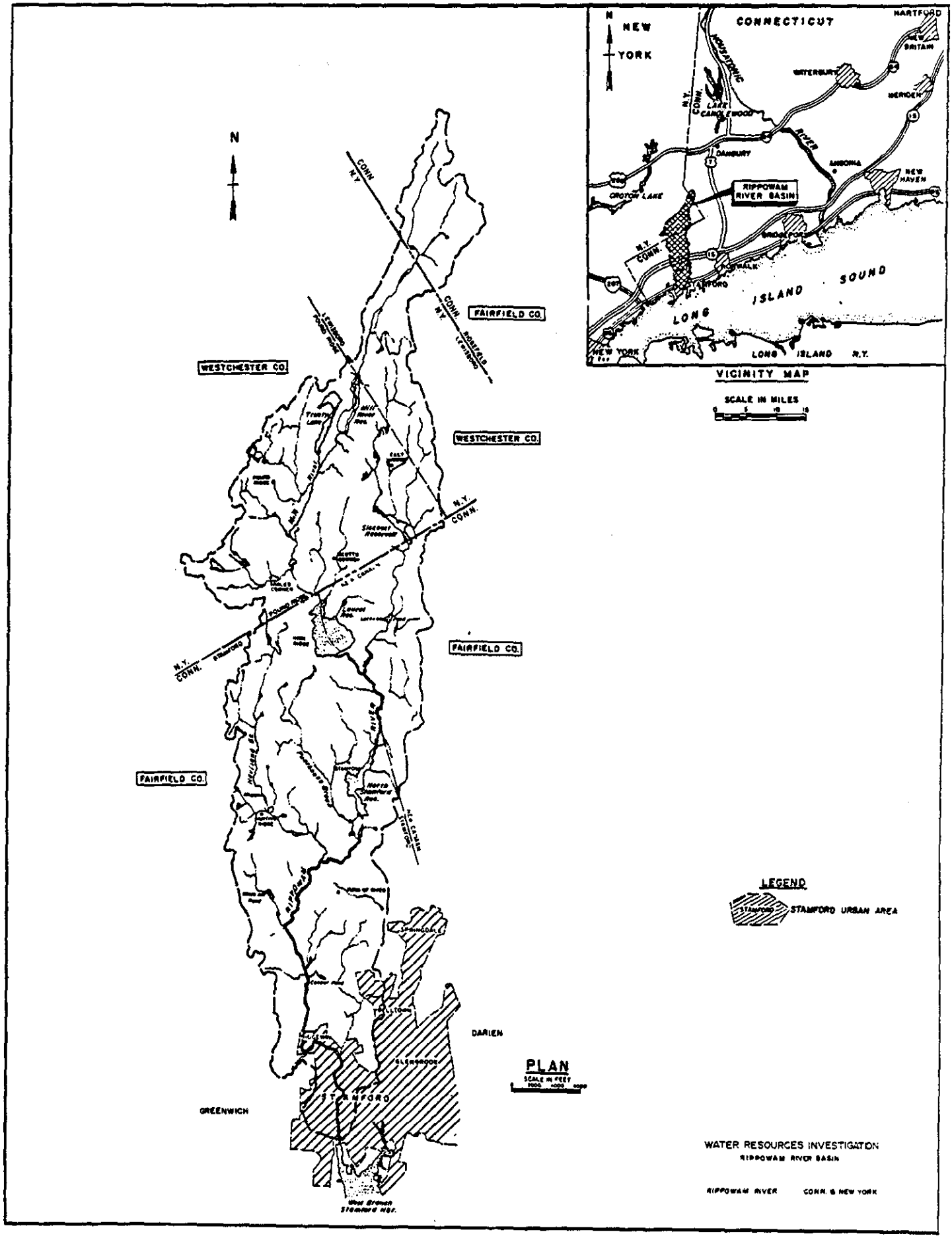
SCOPE OF STUDY

This feasibility report presents results of those studies performed in response to the Congressional resolution. Since no project is recommended for Congressional authorization the study results are summarized. More detailed information may be found in the Detailed Project Report which includes an Environmental Assessment.

For this report, existing information was used with new data being developed only when necessary in determining the feasibility of the alternative plans.

STUDY PARTICIPANTS AND COORDINATION

Investigations and related water resource studies have been coordinated with Federal, State and local agencies, as well as concerned individuals. Meetings, workshops, and newsletters have been used to exchange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NEW YORK
CONNECTICUT
HARTFORD
NEW BRITAIN
WATERBURY
MERIDEN
DANBURY
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FAIRFIELD CO.
WESTCHESTER CO.
WESTCHESTER CO.
FAIRFIELD CO.
FAIRFIELD CO.
DARIEN
STAMFORD
GREENWICH
PLAN
LEGEND
STAMFORD URBAN AREA
WATER RESOURCES INVESTIGATION
RIPPOWAM RIVER BASIN
RIPPOWAM RIVER CONN. & NEW YORK

FIGURE 1

information and consider possible solutions to water resources related problems. Major public meetings were held in 1976 and 1979. The most recent public involvement activity occurred in January 1984 when the selected plan was presented to the mayor of Stamford and other city officials. In April of 1984 a public notice and draft copies of the Detailed Project Report for Local Flood Protection for Stamford was distributed for public review. The results of all studies done in responses to the Congressional resolution were included as well as the rationale for recommending project implementation through the small flood control program.

Coordination with the US Fish and Wildlife Service has resulted in two planning aid letters.

OTHER STUDIES AND REPORTS

This section presents studies and reports by the Corps of Engineers and other Federal and non-Federal agencies which have a specific bearing on this study.

Other Corps Studies

Following the record 1955 flood the New England Division Corps of Engineers conducted an investigation of potential reservoir sites in the Rippowam River Basin. This preliminary study completed in 1956 included field inspections, selection of six possible sites and preparation of cost estimates. The sites, located in the lower watershed, were not economically justified due to the high cost for lands and damages, while the three upper sites did not control sufficient watershed areas to be effective.

Soon after the flood of June 1972 on the Rippowam River, the Corps received requests from the Stamford Environmental Protection Board and from flood plain residents through their Congressman asking for aid in solving their flood problems along the Rippowam River and Toilsome Brook. Reconnaissance studies performed under the Section 205 authority concluded that where solutions would fit within the authority they could not be economically justified. The study also concluded that there were other major problem areas which would exceed the Section 205 authority, and a letter to the city on 2 April 1973 recommended that the flood problems should be investigated using a comprehensive basin analysis rather than a piecemeal approach.

Also in 1972, in response to two Congressional resolutions covering specific parts of the Housatonic River Basin, a study was initiated in the interest of flood control, recreation, navigation, water supply, water quality, and other allied water uses. Later the study area was expanded to include fourteen communities in southwestern Connecticut, including those in the Rippowam Basin, in order to encompass a more comprehensive area water supply analysis.

As part of the national program for the inspection of non-Federal dams, the Corps inventoried three dams in the Rippowam Basin; North Stamford Reservoir, Laurel Reservoir and Siscowit Reservoir. The dam at Laurel Reservoir was studied under Phase 1 of the program. The study conclusion is that the Laurel Reservoir dam is in good condition, however, its spillway does not have sufficient capacity for passing the test flow without overtopping the dam. The spillway does have capacity for the 100-year flow.

Studies Of Others

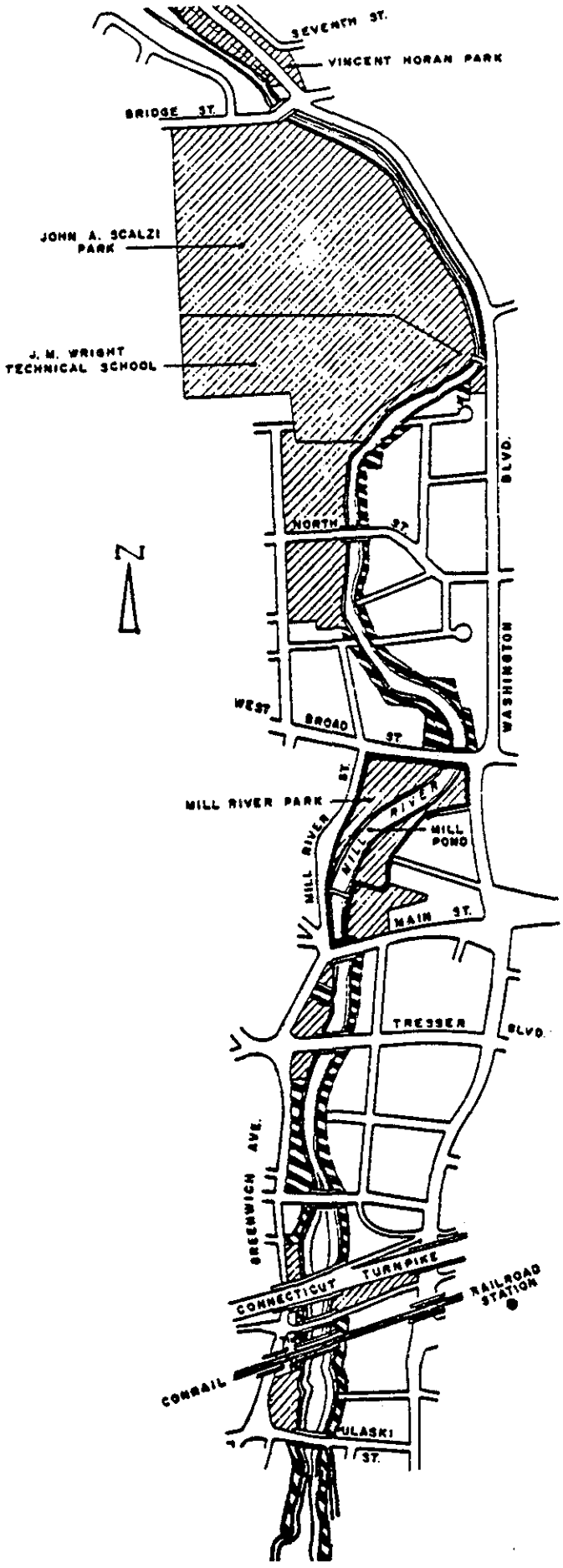
In March 1955 the New England, New York inter-agency committee completed a report entitled, "The Resources of the New England - New York Region". The study, often referred to as the NENYIAC study was a comprehensive survey of the land, water and related resources of the region. This report, completed prior to the record flood of October 1955, did present flood control measures for the basin which included a channel enlargement plan within the lower three miles of the Rippowam. This plan was not economically justified. A flood forecasting warning and evacuation plan was recommended.

During 1963 the State of Connecticut Water Resources Commission conducted flood control channel improvement studies of the Rippowam River. Hydrologic and hydraulic studies were conducted for the 2.8 mile lower river reach and a plan of flood protection was developed. The plan consisted of earth levees, floodwalls and related structures.

The Corps of Engineers was engaged by the Department of Housing and Urban Development (HUD) in 1973 to perform a Flood Insurance Study for the city of Stamford. The purpose of the study was to define the stages and extent of the 100-year flood for coastal areas and river flood plains. In addition to the entire coastal reach of Stamford, detailed analyses were performed on the Mianus, Noroton, and Rippowam Rivers. These evaluations consisted of a determination of the peak discharge and consequent water surface elevations. The draft report was resubmitted to HUD in May 1976. The results of this study were utilized for the emergency phase of the flood insurance program. The city of Stamford is currently participating in the regular phase of the National Flood Insurance Program.

During 1975 a report was released by the New England River Basins Commission entitled, "People and the Sound," which focused on the Long Island Sound. The purpose of the study was to balance the needs to protect, conserve, and wisely develop the Sound and its related shorelands as a major economic and life-enriching resource. A section of the report recommended that Siscowit reservoir, located on the Rippowam River Basin, be raised to provide water supply.

In July of 1976 a report entitled "Shepaug River Diversion for Water Supply to Southwestern Connecticut" was released by a group of consulting engineers. The purpose of the report was to outline an engineering



CONCEPT FOR MILL RIVER GREENBELT

EXISTING CITY OR STATE PROPERTY

DESIRABLE ACQUISITION OR EASEMENT

PREPARED BY THE STAMFORD PLANNING BOARD TECHNICAL STAFF 1977

FIGURE 2

concept for supplying water to the Rippowam River Basin and other areas in Southwestern Connecticut. The Shepaug River was found to have the greatest potential for supplying this need in the near future.

In 1976 the city of Stamford released a study report entitled "Mill Pond." The purpose of the study was to investigate the possibility of improving a riverside park in the downtown area of Stamford. The report recommended that Mill Pond be dredged. Upon completion of the dredging, various functional aesthetic improvements were also recommended for implementation.

In December 1978, The Research Corporation of New England completed a study of urban runoff as a part of the Connecticut 208 program in the Rippowam River area and other areas of south central, central, and southwestern Connecticut. The purpose of this study was to determine whether the quality of water was affected by urban runoff. The final report of the study projected a slight increase in urban runoff loadings in the Rippowam basin. However, the subsequent reduction in water quality from urban runoff would be negligible.

In May 1979 a study report entitled "Hydroelectric Potential at Existing Dams - New England Region" was released by the New England Division in conjunction with the New England River Basins Commission. The study report details the engineering practicability and economic feasibility of both existing and undeveloped hydroelectric sites within the entire New England region. The study report concluded that there is no potential for hydroelectric power development in the Rippowam River Basin.

In December 1979 a report entitled "The Mill River Greenbelt Study" was published by the city of Stamford. The purpose of this study was to determine the feasibility of connecting 90 acres of publicly owned land and an additional 19 acres of water surface area to create a continuous riverside walk and linear recreation greenbelt. The city of Stamford has initiated the implementation of this plan by acquiring some land and obtaining easements. See Figure 2.

THE STUDY PROCESS AND REPORT

The Corps of Engineers has followed a systematic approach in the study by analyzing the problems and opportunities, developing and evaluating alternative management plans to alleviate the problems and by taking advantage of opportunities in water resources and related land resources. This approach is directed by the Water Resources Council's "Principles and Guidelines" which are intended to ensure proper and consistent planning by Federal agencies in the formulation and evaluation of water and related land resources implementation studies.

The study process was directed to meet Federal and Corps guidelines, reflect concerns of citizens, address problems and opportunities of the

area, meet the requirements of the National Environmental Policy Act (NEPA), maintain coordination with other agencies and encourage and obtain public participation.

THE STUDY AREA

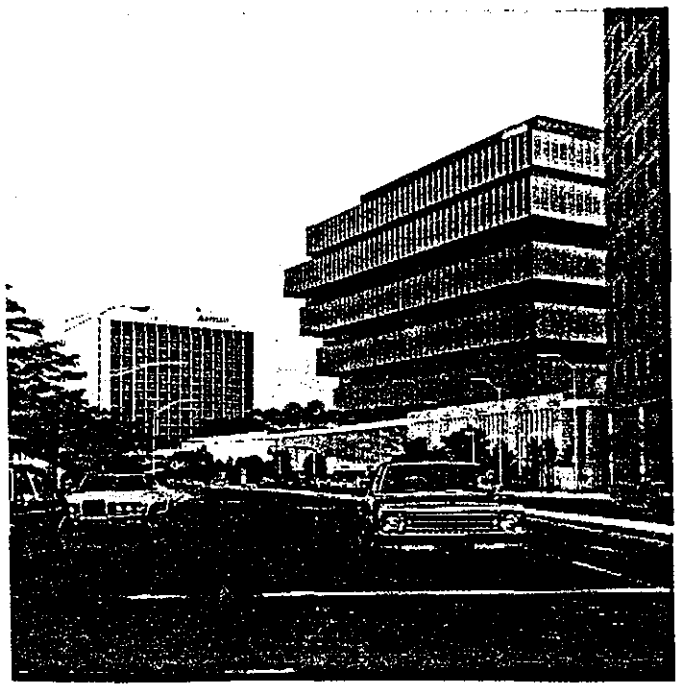
EXISTING CONDITIONS

The Rippowam River Basin shown on Fig. 1. is located in Westchester County, New York, and Fairfield County, Connecticut, two of the wealthiest counties in the United States. The 37.5 square mile drainage basin originates in Ridgefield, Connecticut and empties the Long Island Sound at Stamford, Connecticut. The principal municipalities within the study area are Ridgefield, New Canaan, and Stamford, Connecticut, and Lewisboro and Pound Ridge, New York. The study area north of the Merritt Parkway is rural in nature, while south of the parkway is heavily urbanized. It is in this heavily urbanized area of Stamford, specifically the Rippowam River flood plain that the major flooding problems exist. Stamford has undergone a massive surge in growth within the last 20 years. During this time it grew to become the second largest base for corporate headquarters in the United States. With this increase in corporate development came a corresponding boom in residential development, much of which was in the Rippowam River flood plain. Despite this intense development some open and natural areas do exist. The Rippowam River and adjacent land provide a distinctive greenbelt bisecting the city. This strip of preserved natural habitat contrasts strongly with the surrounding cityscape.

Climate

The Rippowam River Basin has a variable climate and frequently experiences periods of heavy precipitation produced by local thunderstorms and large weather systems of tropical and extratropical origin. Temperatures in the area are less severe than in the more northern interior areas of New England due to its southern location and coastal exposure to the waters of Long Island Sound. Average monthly temperatures vary within the basin from about 70°F during the summer months to the 20's during the winter.

The average annual precipitation over the basin is approximately 45.9 inches quite uniformly distributed throughout the year. The greatest monthly precipitation was 17.2 inches occurring in October 1955. This record flood producing storm originated as an extratropical low pressure area off the Florida coast which stalled off the New Jersey coast in its northerly movement. The warm moist tropical air of the low pressure system overran a northerly high pressure area resulting in intense rainfall over southern New England. Approximately 13 inches of rainfall occurred at Stamford in a 72-hour period on 14 - 17 October. Other intense rainstorms occurred in September 1938 and August 1955 when tropical hurricanes produced storm totals over southern New England of about 10 and 13 inches, respectively.



WITHIN A FEW BLOCKS OF THE RIPPOWAM
RIVER ALONG TRESSER BOULEVARD

A SEGMENT OF THE RIVER GREENBELT
NEAR BRIDGE STREET

Snowfall and snowpack buildup in the basin is considerably less than in the northern interior areas of New England where winters are considerably colder. The average annual snowfall along the Long Island coast as recorded at Bridgeport, Connecticut averages about 34 inches, occurring mostly from December through March.

Streamflow

There are no long term streamflow records for the Rippowam River. In November 1975, a gage was installed by the U.S. Geological Survey on the river near Bridge Street bridge (drainage area = 33.7 square miles) at the request of the Corps of Engineers. Normal flows of the river are highly regulated by the upstream reservoirs. The average annual natural runoff from the basin is believed to be about 25 inches or 50 percent of average precipitation based on records of other streams in the region. This runoff would be equivalent to 68 cubic feet per second (cfs) for the total Rippowam River Basin area of 37.5 square miles. The maximum known flow of the river occurred in October 1955 and based on discharge computations at dams, the peak flow of the river was about 7,000 cfs.

Water Quality

The Rippowam River Basin can be divided into three sections by water quality classification. Above North Stamford Reservoir the waters of the Rippowam and Mill Rivers are classified AA by the Connecticut Department of Environmental Protection. Double-A standards are Connecticut's highest water quality standard and apply to drinking water supply impoundments and tributary surface waters. Waters meeting these standards can be used for domestic supply after simple chlorination.

The Rippowam River is rated Class B from the outlet of the North Stamford Reservoir downstream to the Pulaski Street in the center of Stamford. Class B waters are suitable for swimming and other recreational uses, certain industrial processes and cooling, excellent fish and wildlife habitat, and have good aesthetic value.

Below Pulaski Street the Rippowam River enters the tidewater reaches of Stamford Harbor. The tidal and marine waters of Stamford Harbor are rated Class SB by the Connecticut DEP. Class SB waters are suitable for bathing and other recreational uses, shellfish harvesting for human consumption after depuration, and industrial cooling, provide excellent fish and wildlife habitat, and have good aesthetic value.

Natural Resources

North of the Merritt Parkway vegetation is characteristic of the oak-hickory forest association. Interspersed with these hardwoods are native hemlock, pine, tulip tree and dogwood. The Bartlett Arboretum of the University of Connecticut, situated along Poorhouse Brook, is located just off Route 137 in the upper watershed. It fosters an extensive collection

of native and exotic plant materials which are available for public enjoyment. Five water supply reservoirs located in the upper watershed are owned and operated by the Stamford Water Company. There are also many streams, ponds, and lakes which add to the scenic quality of the river basin. Remnants of glacial action are still in evidence today in the region. Many rock outcroppings and scattered boulders can be found.

Water Supply

The water resources of the upper part of the Rippowam River basin are highly utilized for domestic water supply in Stamford. The Stamford Water Company owns five interconnected reservoirs in the basin; Mill River, Trinity Lake, Laurel, Siscowit and North Stamford. This system provides a dependable yield of about 19 mgd which is about 60 percent of the estimated annual runoff of the basin above North Stamford Reservoir. Stamford Water Company supplies water to about 83 percent of the people in Stamford and also supplies water to the Noroton Water Company.

Ridgefield, Connecticut is supplied by a reservoir and groundwater system. Some areas of Ridgefield are supplied through local sources to individual communities. New Canaan Water Company serves about 10,000 people and is supplied by both the New Canaan Reservoir and a well system.

Geology and Topography

The topography of the study area varies from gently rolling hills north of the Merritt Parkway to a much flatter topography in the city of Stamford. Elevations range from 0 to 800 feet above mean sea level.

The Rippowam River Basin is underlain primarily by igneous and metamorphic rocks belonging to the eugeosynclinal assemblage on the east flank of the Green Mountain anticlinorium. The rocks, consisting of gneiss, schist, and pegmatite, have undergone three periods of metamorphism, corresponding to the Taconic, Acadian and Alleghenian orogenies.

Bedrock in the area is covered primarily by glacial till and glacially deposited sand and gravel. Recent deposits of alluvium and peat are found in streams, flood plains, and low-lying areas. Artificial fill occurs in the developed areas of the basin.

Cultural Resources

A cultural resources reconnaissance which concentrated in the lower two miles of the Basin along the Rippowam River identified two Stamford bridges as potentially significant historical sites. These two bridges are the Cold Spring Road Bridge and the North Street Bridge. It was recommended that these two bridges be studied in more depth before implementing any project which would affect them.

Socioeconomic Resources

Stamford serves as the economic center for the Stamford Standard Metropolitan Statistical Area (SMSA) which includes Stamford, Darien, Greenwich, and New Canaan and is synomymous with the Stamford Labor Market Area (LMA). Data specific to the project area, i.e. the areas immediately surrounding the Rippowam River from Stamford Harbor north to Stillwater Pond, has been included.

Projections of the baseline conditions from which potential impacts are drawn are also provided within this section.

Land Use - Stamford was founded in 1641, an ideal site for a town, offering a good and safe harbor, good land nearby for farming, and a stream to power the local grist mill. Stamford remained a rural village for 200 years and served as a trading post for local farmers and a stop for the New York - Boston stagecoaches.

Stamford has a total area of 39.9 square miles with approximately 95 percent (38.1 square miles) constituting land.

TABLE 1
LAND USE, STAMFORD, CT 1974

Uses	Percentage
Residential	39
Industrial	3
Commercial	1
Public and Semipublic	13
Transportation	11
Parks	6
Vacant	27
Total	100

Stamford consists of a central business district (CBD) just north of the Connecticut Turnpike in the southern portion of the city and a considerable stretch of low-density suburbs in the middle part of the community. North Stamford, north of the Merritt Parkway, is zoned residental and is of very low density with a minimum of one and two acre lots.

During the 1960's, the city initiated an urban renewal program known as the Southeast Quadrant Project in the Central Business District (CBD). Difficulties in relocating people and businesses, and lawsuits by those opposed to urban renewal, delayed renewal activities for almost a decade. During the same period several corporate headquarters located in Manhattan, 33 miles southwest of Stamford, began seeking a new location.

Stamford, as well as Greenwich, were attractive locations because they provide good rail access to midtown Manhattan and are traversed by two major highways, the Connecticut Turnpike (I-95) and the Merritt Parkway. In addition a more favorable tax climate prevails in Connecticut.

Although locations in the CBD may have been preferable for the development of corporate headquarters, the urban renewal problems caused many headquarters to locate in more residential areas along Long Ridge and High Ridge Roads north of the CBD. In the early 1970's General Telephone and Electronics (GTE) decision to locate in the CBD is thought to cause other businesses to also choose the CBD.

The urban renewal planned for the CBD included 130 acres. On this land the Landmark Tower, the GTE Building, the Marriott Hotel, 10 Stamford Forum (the Singer Building), and Champion International headquarters have been constructed. A regional shopping center anchored by J.C. Penney's, Saks Fifth Avenue and Macy's with 100 smaller shops has also located here.

To aid in the development of a master plan, the city was divided into 10 planning districts. The six high flood damage reaches considered in this report lie within four of the ten planning districts. These four districts considered as one area include the heart of the commercial, industrial and high density development within the city. These districts include the Central Business District which has undergone significant urban renewal as well as the heaviest concentrations of industrial development, much of which is old and inefficient. They also encompass areas of the highest residential densities as well as the city's housing of poorest condition.

The Stamford Community Development Program (SCDP) focuses on the preservation and revitalization of inner-city neighborhoods which have been designated as Community Development Target areas.

Economic Activity - Stamford existed as a rural village until the lock manufacturing firm of Yale and Towne set up its plant during the 1860's. By 1900, the plant was the chief manufacturer in town, employing over 11,000 persons. Yale and Towne remained the major employer until 1946 when a strike forced the plant to shut down. Economic growth after that centered on research and engineering activities. At the same time, Stamford was serving as a bedroom community for New York City businessmen, as well as home to well-paid and highly educated scientists, engineers, and researchers causing prices of land and housing to rise. The high cost of land weakened the attractiveness of Stamford to manufacturers.

Stamford is the major urban center in Southwestern Connecticut. The city provides approximately 60 percent of the SMSA's jobs and is an importer of labor with close to 20,000 commuters outside city limits. Stamford is the retail center of the SMSA containing 7 of its 8 department stores and generating about one half of its retail sales. Stamford provides over 5 million square feet of commercial office space and is home to 7 of the Nation's 500 largest corporations.

An older northeastern city, Stamford remains substantially dependent on goods-producing industries and possesses older multistory manufacturing structures. In recent years, however, a number of manufacturing firms have moved to other sites in Fairfield County.

The labor force in the Stamford Labor Market Area (LMA) numbered an average of 120,806 in 1980, with an unemployment rate of 4.1 percent. Residents of Stamford made the greatest contribution to the unemployment rate, accounting for 67.6 percent of the unemployed. At the same time, Stamford provides the LMA with just over 50 percent of the area's labor force. The LMA's unemployment rate ranged from 3.6 percent to 5.4 percent of the labor force during 1980, averaging 4.1 percent for the year and remaining below statewide and national unemployment levels which averaged 5.9 and 7.1 percent respectively for 1980.

Population - Population in the Rippowam River Basin is concentrated in the city of Stamford. Stamford's population almost doubled between 1940 and 1960. Its population continued to increase between 1960 and 1970. However, between 1970 and 1980 Stamford's population showed its first loss of 5.8 percent or 6,345 persons. The Stamford SMSA also showed its first population loss of 3.7 percent or 7,565 persons. Stamford's population (1980) makes up just over 50 percent (51.5 percent) of the SMSA's total population. New Canaan was the only community in the SMSA recorded to have grown in population between 1970 and 1980. A rather modest growth of 476 persons or 2.7 percent occurred. With the exception of New Canaan, then, this area countered the statewide trend of a 2.5 percent population increase. Population figures are presented in Table 2.

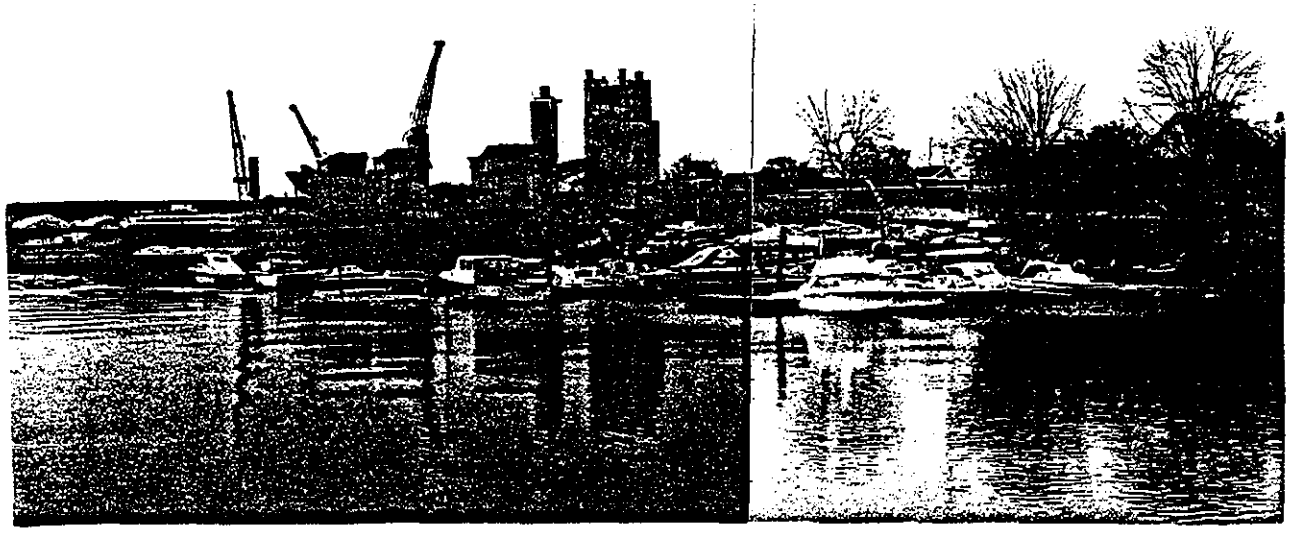
TABLE 2

POPULATION

	1940	1950	1960	1970	1980
Stamford	47,938	74,293	92,713	108,798	102,453
New Canaan	6,221	8,001	13,466	17,455	17,931
Stamford SMSA	98,890	134,896	178,409	206,419	198,854
Connecticut	1,709,242	2,007,280	2,535,234	3,031,709	3,107,576

Close to 40 percent (38.1) of the city's total population lies in the four planning districts that contain the major flood damage reaches. These four districts, however, approximate one quarter of the city's land area.

Transportation - The cities and towns of the Rippowam River Basin are served by two major east and west highways: The Merritt Parkway and Connecticut Turnpike (I-95). They are complemented by Route 7, running north and south, which connects the east and west routes with Interstate-84 to the north and provides access to the Danbury, Connecticut region.

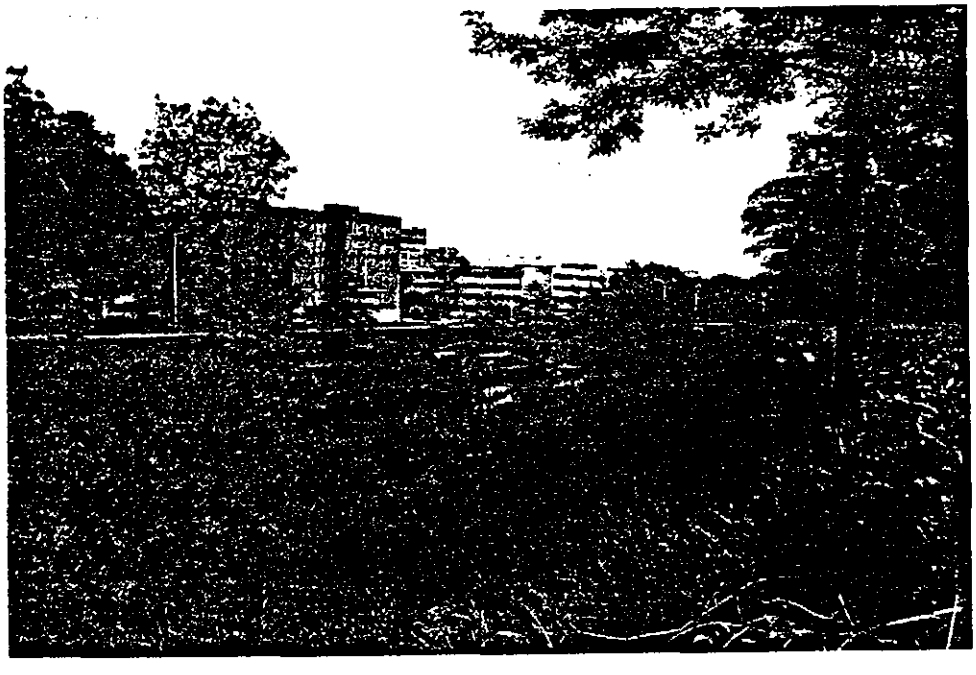


WEST BRANCH STAMFORD HARBOR TIDAL REACH

DOWNSTREAM OF PULASKI STREET

MAIN STREET DAM - MILL POND PARK

NORTH STREET BRIDGE



RIPPOWAM AT SCALZI PARK - WASHINGTON BOULEVARD ON LEFT
DOWNTOWN STAMFORD IN BACKGROUND

Commuter rail service is provided by Amtrak to New York City, to Washington, DC, and to Boston, Massachusetts. Recent capital expenditures by Amtrak have made a significant improvement in service, and ridership has increased after years of decline. Rail freight service, on the other hand, has been declining. The formation of Conrail may reverse this trend. In past years, three major rail freight systems had been available until reduced to one. As a consequence an increase in trucking has developed.

New York's LaGuardia and Kennedy airports are a convenient distance from the city of Stamford. The nearby commercial facilities are Westchester County Airport, located 11 miles from Stamford, and Bridgeport Municipal Airport located 25 miles from Stamford.

Access within the city itself has suffered with the intense development in Stamford's downtown area. This development has generated more auto trips and at the same time has reduced the amount of land that could be used for highway purposes. Millions of dollars have been spent on traffic improvements over the last several years.

FUTURE CONDITIONS WITHOUT A PROJECT

This section describes the most probable future condition for the city of Stamford as well as generally for the region. This condition assumes no new Federal water resources developments in the basin. This "without plan" condition is then compared to" with plan" conditions to assess and evaluate the impacts of alternative plans.

Land Use

The city of Stamford is a member of the South Western Regional Planning Agency (SWRPA), along with Darien, Greenwich, New Canaan, Norwalk, Weston, Westport, and Wilton. This planning agency has established some basic goals to guide development and has provided policy for development in its 1974 regional plan of development "Toward the Region of the Future." Specific plans and implementation proposals concerning overall land use, open space, commercial centers and economic development, sewage and water supply, transportation, and housing were included.

The principal features of the development plan are directed toward a plan which closely resembles a composite of municipal plans; proposes a one-third increase in the total amount of open space; provides for a variety of residential areas; discourages development where topography and soils are poor; recognizes downtown Stamford as the major urban center of the region; reinforces the trend toward linear development patterns due to the coincidence of rail and expressway transportation facilities in the I-95 and US-7 corridors; concentrates major office and commercial centers, manufacturing, and industrial land uses in areas accessible to expressway and rail facilities; and proposes linear parks to connect major open space and recreation areas.

The plan promotes downtown Stamford as the business and cultural center of the region, characterized by a concentration of corporate office headquarters and major department and other retail stores. Recent development in Stamford has been compatible with these goals.

The recent Policy Plan for the City provided recommendations for future development and growth specific to each planning district, as well as established some general policies and goals for the city as a whole.

As mentioned earlier, four of these planning districts, encompass the major floodprone areas within Stamford. These areas consist of a mix of commercial, industrial, and residential uses with little vacant land available for development.

Recommendations for guiding future development in these districts calls for a comprehensive plan to promote compatible uses. The main theme in future planning is the creation and maintenance of a "living city" environment with a mix of mutually supportive office, residential, retail, and cultural activities.

The central issue emerging from a recent evaluation of Stamford's plan is the lack of a growth management policy. What is needed therefore is a specific idea of how much growth should occur and how this growth should be directed. Along with this is a need for coordination and dialogue so that neighborhood priorities can be established.

The downtown district is near the end of an extensive revitalization effort. The basic concept of the project was to intensify the core area of the city and bring people back to the downtown by providing a vibrant interaction of central city functions. With the completion of the Southeast Quadrant Project there are no large tracts of vacant land available. On the fringes, however, there is room for considerable intensification of land use under existing zoning.

Development recommended in the policy plan is hoped to link uptown areas north of Broad Street with the downtown. The plan suggested establishment of a special "Office Building District" to promote a somewhat exclusive district of offices as the primary use and ancillary retail such as banks, stationery stores, drug stores. There is limited vacant land within this area. The planning board feels that development of these tracts should be sensitive to the bordering neighborhoods, in which case commercial and high density residential uses should be prohibited.

The area of Stamford south of the Connecticut Turnpike has the greatest problems of overcrowding and substandard conditions citywide. Required for improvement of these areas is the separation of incompatible uses, addition of breathing space, vigorous code enforcement, and a joint effort at community maintenance. The potential for waterfront development should be encouraged. The harbor area promotes a strong market for hotel,

office, or apartment development. As part of the Community Development Program, the Water Street Park is now being developed as a passive recreational facility overlooking the harbor. Additional development for another recreational facility or small wharf to meet neighborhood needs is being considered.

The area just north of the turnpike and west of the river accommodates some of Stamford's densest development. Again, there is very little vacant land remaining in this area. The policy plan recommends a general upgrading of existing commercial and residential uses in terms of aesthetic and functional improvements.

In addition to some general goals for meeting transportation and housing needs, recreation, especially open space conservation was a primary concern. In December 1979, a development proposal for a riverside park was provided to the city by Environmental Design Associates (EDA). EDA's report was prepared with grant monies from the State and the National Center for the Endowment of the Arts. The park extends a distance of 1.9 miles along the Mill (Rippowam) River from the Pulaski Street Bridge north to North Forest Lawn Avenue. The Mill Pond portion of Mill River Park would be improved in accordance with the recommendations made by the Mayor's Mill Pond Committee. This would include acquisition of a few key riverbank properties that would then permit a continuous central park along the 1.9 mile distance from the Pulaski Street Bridge to North Forest Lawn Avenue. The Mill Pond at the center of this concept is within one mile of half the population of the city. This central park concept could provide another link between downtown and uptown. A riverwalk could traverse the entire 1.9 mile length of the greenbelt for jogging, bike riding, hiking, and strolling, thus, a pedestrian link of downtown and uptown. Communities on the west side of the river would benefit from being linked with the Central Business District and extensive recreational facilities.

Economic Activity - Stamford's continued development as a major center for corporate headquarters is reflected in projections of occupational employment and demand during the first half of the 1980's. Clerical employment is expected to show the largest increase of approximately 12 percent from 1980 to 1985. Following clerical increases in size are increases in professional and technical employment and managerial employment. Agricultural employment is expected to decline during this period.

Total employment in the Stamford LMA (Darien, Greenwich, New Canaan and Stamford) is expected to rise from 115,803 in 1980 to 123,960 by 1985, an increase of 7.0 percent.

The trends in Stamford's manufacturing base are similar to those in many urban centers. These trends include an increasing importance of office functions associated with major manufacturing companies, and a decreasing importance of production activities.

Stamford does have good potential to attract a continuing flow of smaller industrial firms into the city, especially firms relocating from New York City. Typically these firms would be seeking lower taxes, better executive living facilities, and shorter commutes. There is also a possibility of new companies locating in the low priced space available in the south end of Stamford.

Evidence exists that the New York region is decentralizing and that New York City's dominance over the area is decreasing. This trend is expected to continue.

The goals of the South Western Regional Planning Agency include the economic development of designated areas. These areas, ideally, should have the best possible relationship to existing and proposed transportation, utilities, and other services. Downtown Stamford, with its concentration of office headquarters and major stores, is recognized as the center of the metropolitan community. Gradual, orderly growth of Stamford and the surrounding community is desired.

Population - No population projections based on the 1980 Census figures are available. Most recent projections for the Stamford area are made by the SWRPA. These projections, however, provided a 1980 figure which was not borne out by the actual 1980 Census figures. The projections indicated growth for all SMSA communities, where in reality all communities with the exception of New Canaan lost population. The decrease noted in 1980 indicates a stabilization of Stamford's population. It is felt that the city's maximum population would be 124,000, however, the date at which this population would be reached is further off than first anticipated.

Water Resources - Water supply projections for the study area have been made in the Corps' Housatonic River Basin Urban study. Using 1980 as the base year, projections for water demand were made for the year 2000 and 2030 for short-term and long-term needs, respectively. By using population projections and simplifying assumptions on future water use the results show that without further water supply development only Ridgefield, Connecticut will show a deficit in the near future. In the long-term projection Stamford Water Company and New Canaan Water Company join Ridgefield in having projected deficits.

It is unlikely that future water supply deficits will be experienced since the southwestern areas of Connecticut are actively seeking solutions to the future water supply problems on a regional basis.

It is also unlikely that the existing flood problem will significantly change in the future without implementation of a flood protection plan. With all communities participating in the National Flood Insurance Program, and implementation of zoning and other land use regulations which control development in the flood plain, there should be little change. It is likely that land use will change as well as types of

flood damage associated with new uses. Implementation of Stamford's greenbelt plan would, over time, replace some residential and commercial flood prone properties with open space. Conversions of single family residential areas to commercial and condominium use is another trend which is likely to continue.

PROBLEMS AND OPPORTUNITIES

The problems and opportunities presented in this section were identified through technical analysis and interaction with the public, and other agencies.

FLOOD PROBLEM

The immediate and critical need of the Rippowam River Basin is for reduction of flood damages caused by major storms and early spring rains combined with melting snow. The basin is also exposed to occasional coastal storms. In the late summer and the autumn months these storms, usually accompanied by heavy precipitation, occasionally attain hurricane intensity, thus posing a serious flood threat to the basin. The hurricanes and storms of September 1938, September 1944, August 1955, and October 1955 were of this type. More recent flooding has occurred during June 1972 (Hurricane Agnes), September 1975, October 1975, and January 1976. Bank full flows occurred several times early in 1979 and more recently in March and April 1980 and in April 1984.

The problem of flooding is most serious within the highly urbanized lower watershed area. The frequency of flooding events has increased during recent years due to development of vacant land in the midbasin area. Upstream reaches of the basin are less developed and do not suffer a serious flood problem. Minor localized flooding occurs at some crossings in North Stamford but is generally no more than nuisance to nearby residents.

The timing of flooding is particularily important since the Rippowam River is a flash flood stream. Depending upon the location of a storm, the lead time from rainfall to flooding is generally in the order of 2 to 6 hours.

Flooding is caused by a variety of reasons related to river flow capacity. For most of the Rippowam River between Pulaski Street and Cold Spring Road in Stamford the streambed gradient is flat. This combined with past encroachment of the channel severely limits its capacity. Seven bridges located in this reach create serious flow restrictions. These bridges have historically collected heavy debris further limiting their ability to pass floodflows. Siltation in the channel, especially in the Mill Pond area between Main Street Dam and Broad Street requires periodic removal.

October 1955 Flood - As stated earlier, the greatest flood known on the Rippowam River occurred in October 1955 as a result of heavy rainfall in the period 14-17 October. The storm was generally centered over the Rippowam basin with just over 13 inches of rain recorded at the North Stamford reservoir. During the storm almost eight inches of rain fell in a period of 12 hours. This storm occurred following the heavy rains of August 1955 so antecedent conditions were still relatively high for that

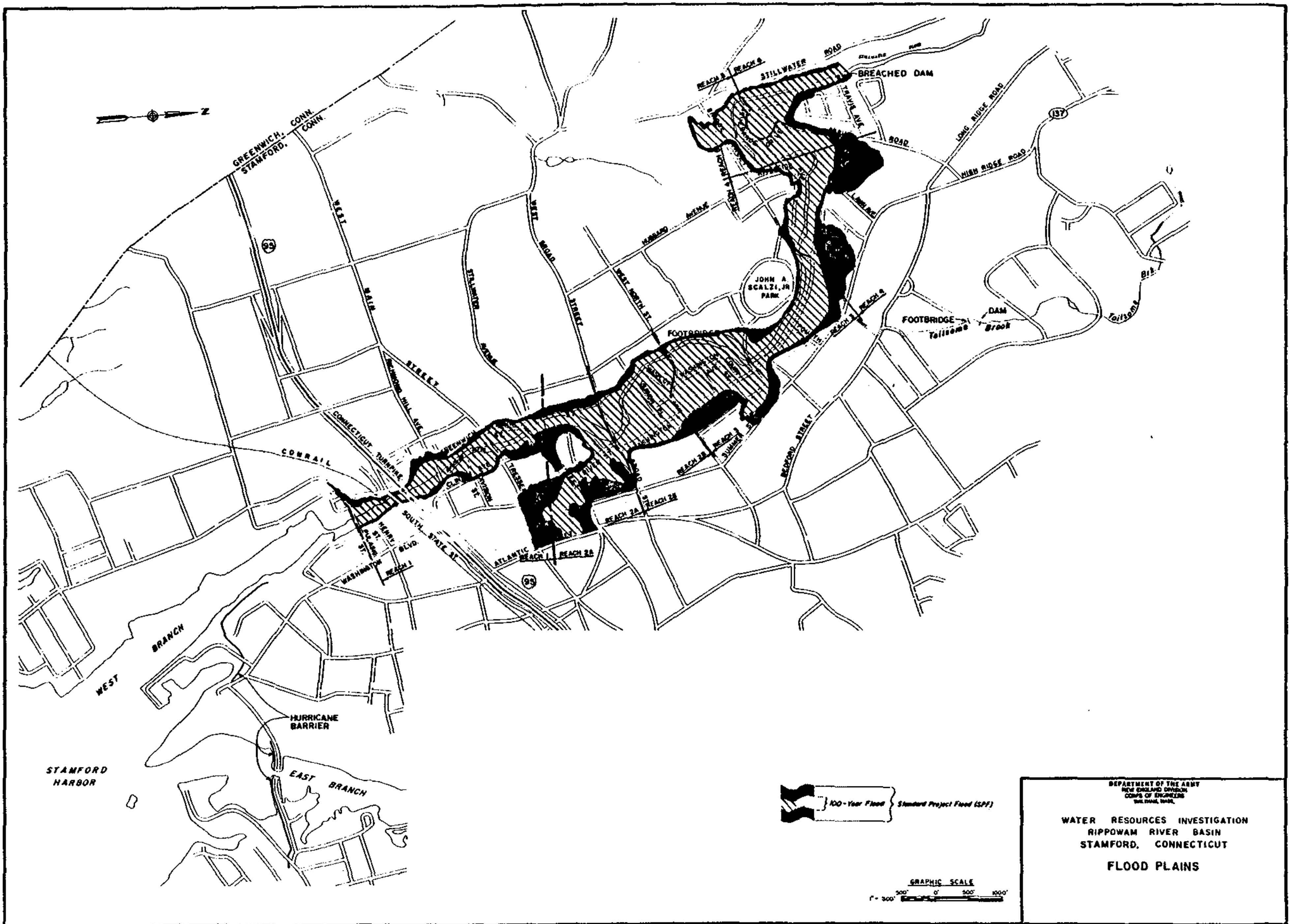

GREENWICH, CONN.
STAMFORD, CONN.
BREACHED DAM
STILLWATER ROAD
TRAVIS AVE.
LONG RIDGE ROAD
HIGH RIDGE ROAD
JOHN A. SCALZI, JR PARK
FOOTBRIDGE
DAM
Toilsome Brook
WEST MAIN STREET
WEST BROAD STREET
STILLWATER AVENUE
HUBBARD AVENUE
WEST NORTH ST.
CONNECTICUT TURNPIKE
CONRAIL
SOUTH STATE ST.
WASHINGTON BLVD.
ATLANTIC
BEDFORD STREET
REACH 1
REACH 2A
REACH 2B
REACH 3
REACH 4
REACH 5
REACH 6
WEST BRANCH
EAST BRANCH
HURRICANE BARRIER
STAMFORD HARBOR
100-Year Flood
Standard Project Flood (SPF)
GRAPHIC SCALE
500' 0' 500' 1000'
1" = 500'
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.
WATER RESOURCES INVESTIGATION
RIPPOWAM RIVER BASIN
STAMFORD, CONNECTICUT
FLOOD PLAINS

FIGURE 3

time of year. The peak discharges at North Stamford reservoir and the mouth of the river were computed to be 4,300 and 7,200 cfs, respectively, which was in general agreement with the experienced flows and closely approximates a 100-year event.

The flood plain resulting from the 100 year or a recurrence of the October 1955 flood as shown on Figure 3 would cover over 100 acres of heavily populated urban area between the mouth of the river and the Cold Spring Road Bridge in Stamford.

Although the estimated flow for the October 1955 flood and the computed 100-year flow are approximately equal, the flood plains differ in the lower two miles of the Rippowam. This disparity is due to the failure of the Stillwater Pond Dam 1,500 feet upstream of Cold Spring Road. It has been estimated that the failure occurred just prior to the flood crest causing a one time surge of water over that which would have occurred from runoff alone. This surge caused higher stages and a larger flood plain in some reaches downstream of the dam than would result in a recurrence of that storm.

For the purposes of this study the October 1955 and the 100-year floods are considered to be approximately equal in flow. The Stillwater Pond Dam having been breached would not be a factor in future flood events.

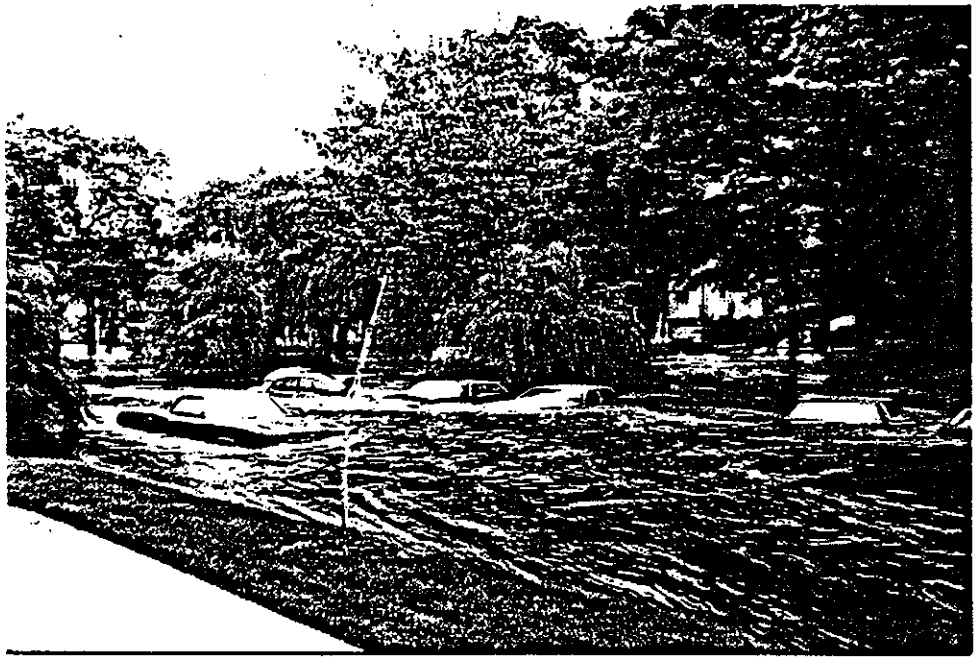
The impact of the 1955 flood was felt mainly by commercial and residential structures. Total damages of $26.0 million could be expected if the October 1955 flood were to recur under 1983 conditions. In addition to the property damage was the threat to life, disruption of public activities and other non-monetary impacts. Isolated areas of flooding also occurred upstream of the Cold Spring Road area.

June 1972 Flood - Another major flood occurred in June 1972. Though this flood was much smaller in magnitude than the October 1955 event it did produce considerable damage and great concern in Stamford. The flood was compounded by the great amount of new development that had taken place in the city of Stamford mostly in the preceding decade.

The June 1972 event was produced by a storm rainfall between 6 and 7 inches occurring mostly in a 24-hour period on 18 and 19 June. The storm over southern Connecticut was separate from, but somewhat of a forerunner of the great "Agnes" storm of 21 and 22 June.

Storm totals at Bridgeport, Connecticut agreed closely with those at Stamford. Experienced peak flows on the Rippowam for this event were not known since there was no stream gage on the river at the time. Applying the rainfall to a theoretical model and assuming upstream reservoirs initially full, resulted in computed peak flows of about 1,700 and 4,000 cfs at North Stamford Reservoir and the mouth of the river, respectively. These flows are considered generally representative of what occurred.

JUNE 1972 FLOOD - SEVERANCE DRIVE



JUNE 1972 FLOOD - CONDOMINIUMS

BETWEEN BRIDGE STREET AND COLD SPRING ROAD

Newspaper accounts and statements made at public meetings indicate the severity of this event which has been estimated to have a 20-year frequency for recurrence. According to these accounts floodwaters overflowed the banks of the river forcing schools to close and evacuation of many homes to take place. Many had to be evacuated by boats and taken to a makeshift evacuation center at Stamford High School gymnasium. Flooding was concentrated at the low-lying areas on Washington Boulevard and the Cold Spring Road-Severance Drive area. On Severance Drive, 40 cars parked behind a comdominium complex were flooded by waist level water. Electricity was shut off in this area for safety reasons. It was this flood which initiated the interest of Stamford officials to seek Federal assistance in solving their flood problem.

Flood Damages Reaches - In order to assess flood damages, the river was subdivided into six reaches as shown on Figure 3. Within these reaches water depths are relatively consistent. Table 4 shows the effects of a recurrence of the 1955 flood or a 100-year flood under today's (1983) conditions.

In addition to the major flood problems in the lower two miles of the Rippowam damage areas upstream of Reach 6 have also been identified. These are small isolated areas which include Cedar Heights Road, Maltbie Avenue and Buckingham Court, all just south of the Merritt Parkway. Flooding has also been a major problem along Toilsome Brook, a tributary entering the Rippowam through underground conduits just downstream of Fourth Street. The city of Stamford has made the necessary improvements to relieve this problem. Numerous local drainage problems have also been identified. Communities upstream of Stamford have not identified any flood problems within their jurisdictions.

TABLE 4

FLOOD PLAIN AREA, DAMAGES AND
NUMBERS OF STRUCTURES FLOODED BY TYPE
1983 Dollars for Recurrence of Oct 1955 (100-Year) Flood

Damage Reach	Acres Flooded	Damages	Types of Structures Flooded				
			Commercial	Public	Residential	Bridge	Total
1	25	$6,037,000	36	1	19	4	61
2	53	4,125,000	15	1	29	1	46
3	46	7,100,000	30	2	53	2	87
4	14	1,408,000	5	0	34	0	39
5	22	1,367,000	6	0	20	0	26
6	15	1,350,000	0	0	51	1	52
TOTAL	175	$26,387,000	92	5	206	8	311

A standard project flood (SPF) was determined for the Rippowam River by applying standard project rainfall to a computer basin model. SPF computations were made assuming the upstream reservoirs initially full. The standard project rainfall for the Rippowam basin had a 24-hour total of 11.7 inches with over 8 inches occurring in a 6-hour period. The short duration high intensity rainfall resulted in computed peak flows at North Stamford Reservoir and the mouth of the river of 7,000 and 11,600 cfs, respectively.

The SPF flood plain is illustrated on Figure 3. This flood plain would cover about 233 acres within the six damage reaches in Stamford. If the event had occurred in 1983, damages of about $41.0 million would have occurred with loss of life very likely.

Annual Flood Damage Losses - Recurring losses summarized by stages were combined with hydrologic stage frequency data. The damage-frequency relationship determines an annual loss figure which is utilized in the determination of annual benefits. The annual losses shown on Table 5 represent the average annual flood damage which will occur given the probabilities associated with floods of different magnitudes.

TABLE 5
AVERAGE ANNUAL FLOOD LOSSES
By Type of Structures
($000's October 1983)

Reach	Residental	Commercial	Public	Bridge	Total
1	328.4	650.6	11.1	244.5	1,234.6
2A	0.9	9.9	0.2	0.0	11.0
2B	20.5	302.1	0.3	7.6	330.5
3	76.5	167.3	4.5	4.4	252.7
4	20.1	36.8	5.2	5.3	67.4
5	30.2	41.4	0.0	0.0	71.6
6	54.3	0.0	0.0	2.3	56.6
TOTAL	530.9	1,208.1	21.3	264.1	2,024.4

WATER SUPPLY

Future projections of population and water supply needs as described in the previous section show that within the basin Ridgefield will show a deficit of 0.28 mgd by the year 2000. By the year 2030 Stamford Water Company and New Canaan will have deficits of 5.0 mgd and 0.29 mgd, respectively. Ridgefield's deficit will increase to 0.7 mgd. There are no significant water supply problems which warrant a Corps involvement.

RECREATION

The city of Stamford has indicated both in their Recommended Policy plan and in meetings with the mayor and his staff that they consider the Rippowam River a major recreation resource for not only Stamford but for the region. In keeping with this philosophy the city of Stamford has investigated a plan for land acquisition along a mile reach of the river in the commercial center of Stamford which would provide a gathering place for citizens, with access to Mill Pond for skating and boating, an amphitheater, a pedestrian bridge which would span the pond and many other functional and aesthetic measures. The linear open space acquisition or greenbelt as described previously would complete the city's plan.

OTHER PROBLEMS AND OPPORTUNITIES

In addition to the major problems of recurring flood damage, future water supply needs and recreation are other water resources related problems and opportunities.

Directly related to flooding are the problems of continued development in the flood plain which, in many cases, inhibits the movement of overbank flows to the degree that adjacent properties experience increased damages. Although the city of Stamford has regulations to control unwise development in the flood plain some problems continue as the pressure to develop vacant land increases.

The occurrence of high flows in the Rippowam River often result in significant streambank erosion. Since the June 1972 flood several requests for assistance dealing with streambank erosion have been received by the Corps.

Problems of concern to the general public not already mentioned include a decline in water quality, reduced wildlife variety and numbers, and interior drainage flooding.

THE FEDERAL OBJECTIVE

The Federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the Nation's environment. Contributions to national economic development are increases in the net value of the national output of goods and services, expressed in monetary units.

PROBLEM AND OPPORTUNITY STATEMENTS

The Federal objective for the study is expressed through the following problem and opportunity statements which were developed with an understanding of the present and future needs of the study area. They provide guidance in the formulation of complete water resources plans as well as a standard for comparison in the evaluation of each proposal's achievement

throughout the 100-year period of analysis beginning in 1984. The problem and opportunity statements are as follows:

o Reduce flood losses in the Rippowam River flood plain to permit increased commercial activity, and reduce damages to private, commercial and public properties.

o Protect and enhance the aesthetic attributes of the Rippowam River and its flood plain.

o Protect the water quality of the Rippowam River.

o Protect the fish and wildlife habitat of the Rippowam River.

PLANNING CONSTRAINTS

Constraints which could limit the types of plans or plan effectiveness during the period of analysis are presented in this section. The most significant constraint in the highly developed urban area of Stamford, Connecticut is the lack of physical space for safely conveying floodflows. The Rippowam River has been confined to a very narrow channel after being encroached on by past development. This condition is further aggravated by a series of restrictive bridges within the lower two miles of river. These features combined with a naturally flat gradient severely restrict flow capacity of the river and local flood control options.

The city's existing and proposed plans for developing a greenbelt along the lower two miles of the river would maximize the recreational use of the existing riverbank. Any measures to modify the channel in this reach would have major consequences on the greenbelt plan as competition for space is a major problem.

Development in the reaches upstream of the urban area in Stamford, New Canaan and Pound Ridge, New York has been steady and affluent. Property values in these areas as well as topography severely limit the placement and feasibility of upstream flood storage. Land surrounding existing water supply reservoirs is also limited.

Environmental features such as riparian habitat and wetland areas provide valuable fish and wildlife habitat that could be destroyed or severely impacted by project features.

As flash floods are characteristic of the Rippowam River response time is limited to less than 12 hours during life threatening events. The effectiveness of temporary evacuation of people and flood fighting is limited under these circumstances.

In urban areas, provision of a basic drainage system to collect and convey the local runoff to a stream or to a major drainage outlet is a non-Federal responsibility. Water damage problems may be addressed under

the flood control authorities downstream from the point where the flood discharge is greater than 800 cubic feet per second to the 10-year flood under conditions expected to prevail during the period of analysis. Toilsome Brook fits into the category of local drainage and is therefore a non-Federal responsibility.

PLAN FORMULATION

Alternative measures which meet study objectives were investigated to a sufficient degree to determine their economic and engineering feasibility, the associated impacts resulting from their implementation and public acceptance. This section describes the alternative measures and plans which were investigated and the iterative process used to screen them.

MEASURES TO REDUCE FLOOD DAMAGE

Measures which address the primary problem of flood damage fall into four categories and accomplish the following: modify floods, modify flood damage susceptibility, mitigate impacts from damages and accept damages. Within these general categories are more specific alternatives which may also take advantage of opportunities in the areas of water quality and recreation. The four categories of measures including combinations and more specific plans are indicated on Table 6 and are described in following sections.

TABLE 6

ALTERNATIVE APPROACHES TO FLOODING

I. MEASURES TO MODIFY FLOODS

- A. Control the Land Runoff
  - 1. By Land Treatment
  - 2. By Conservation Measures
- B. Impound Floodwaters
  - 1. Modify Existing Reservoirs
  - 2. Construct New Reservoirs
  - 3. Optimize Operation of Existing System of Reservoirs
- C. Improve the Channel Capacity
  - 1. By Channel Enlargement
  - 2. By Removing Natural and Man-Made Obstructions
- D. Confine Flow - Levees and Floodwalls
- E. Bypass Flow to Avoid Damage Area - Tunnels

II. MEASURES TO MODIFY FLOOD DAMAGE SUSCEPTIBILITY

- A. Flood Proof
- B. Forecast, Warn and Evacuate
- C. Control Development in the Flood Plain
  - 1. Regulate land use
  - 2. Building and Housing Codes
  - 3. Public acquisition of flood prone land

III. MEASURES TO MITIGATE SUFFERING FROM DAMAGE ACCEPTED

A. Flood Insurance
B. Assist in emergencies (rescue and aid)

IV. ACCEPT THE DAMAGE

V. COMBINATIONS OF MEASURES

Some plans have either been accomplished to one degree or another or are planned for the future by State and local entities. Each plan was analyzed economically in terms of its cost, benefits provided, and feasibility. Those plans which did not make a net positive contribution to the study objectives were eliminated from further analysis. Those plans which were considered further were assessed in terms of social, environmental and economic impacts. Public acceptance was considered in the assessment and evaluation for all plans.

CORPS PROJECTS AND PLANS OF OTHERS

Hurricane Protection Project - This project authorized by the Flood Control Act of 1960 and completed in January 1969 provides protection against hurricane tides in Long Island Sound for approximately 460 acres of Stamford. Within the protected area are located some of the principal manufacturing plants of the city, residential sections, and a portion of the main commercial district. The project consists of three structures. The East Branch barrier is constructed as an earth-fill dike, with rock faces and toes. The West Branch protection consists of a concrete wall, a sheet pile bulkhead wall, an earthfill dike or barrier and a pumping station. The third unit at Westcott Cove consists of an earthfill levee and pumping stations. The West Branch protection provides protection just downstream of the study area at the mouth of the Rippowam River. The location of the barrier is shown on Figure 3.

Plans Of Others - Plans which address or affect the study objectives which have been implemented or are planned by non-Federal agencies are described in this section. In the general category of Modifying Floods as shown on Table 6, local communities have encouraged and enforced measures which control the land runoff by both land treatment and by conservation measures. The Stamford Environmental Protection Board, and the Connecticut Department of Environmental Protection regulate flood plain encroachment ordinances within the city through the city zoning enforcement officer and establish restrictions in flood prone areas.

There are five reservoirs in the basin, owned and operated by the Stamford Water Company for water supply purposes, which also have an effect on flood flows in downstream areas.

The city of Stamford has made modifications to the Rippowam River which has improved channel capacity. During construction of Washington Boulevard, between Woodside Road and Bridge Street, the river channel was shifted to the west and straightened resulting in improved channel capacity.

In the autumn of 1983 the city of Stamford began installing an automated flood warning system to supplement existing structural and non-structural flood damage reduction measures. The system, known as ALERT (Automated Local Evaluation in Real-Time), is being implemented with the cooperation of the National Weather Service.

The ALERT System consists of a network of six precipitation gages, six stream gages, two temperature sensors, and two base stations. Three watersheds are covered by the system including: (1) the Rippowam River, (2) the Mianus River, and (3) the Noroton River. When in operation the system will be able to forecast a serious flood potential and give the city the opportunity to issue a flood alert and begin the warning phase. During various phases of alert the current and projected flood threat would be communicated to the public and preparations made for evacuation in case may be required. If warranted, evacuation orders would follow the warning phase. To insure orderly and efficient evacuation, well planned and rehearsed actions are necessary. These actions should include the establishment of rescue, medical and fire squads, identification of rescue and emergency equipment, identification of priorities for evacuation, and surveillance of evacuation to insure safety and protect property.

The city of Stamford has joined the Federal Flood Insurance program through the Federal Emergency Management Agency (FEMA) and as of February 1981 is participating in the regular program. The city has adopted strict flood plain land use controls which exceed the requirements of FEMA. New Cannan, Ridgefield and Pound Ridge in New York are also in the Federal Insurance Program.

A greenbelt plan has been developed by the city of Stamford for the Rippowam River. This plan as described earlier in this report would be a major constraint to any modification to the river channel but it is also a compatible use of flood plain lands.

PLANS CONSIDERED IN PRELIMINARY PLANNING

Measures To Modify Floods

Control Land Runoff - Control of land runoff by means of land treatment and conservation measures would have very little effect in the highly urbanized portions of the study area. Existing local regulations, recognizing the effects of unregulated development, already control new construction where applicable. The Stamford Environmental Protection Board when reviewing permits, may require the application to provide on-site storage to limit drainage from the site to pre-project conditions.

Impound Floodwaters - This concept of flood protection was investigated by following three approaches: modify existing reservoirs, construct new reservoirs and optimize the operation of existing reservoirs to allow additional space for flood control storage.

Of the five existing water supply reservoirs in the basin, only three; Laurel, North Stamford and Siscowit have a potential for modification.

Flood control storage would be added to Laurel and North Stamford Reservoirs in order to impound as much water as possible, equivalent to 6 inches of runoff at both reservoirs. Structural modifications include: raising critical sections of the dams, installing tainter gates and providing an overflow spillway. A saddle dike, acquisition of lands and the relocations of State and local roads would also be required.

The estimated first cost of modifying both Laurel and North Stamford Reservoirs to provide flood control storage would be $28,000,000. With only limited flood damage reduction benefits, the benefit to cost ratio would be 0.6 to 1. Because this measure was not economically justfied and incurred major public opposition it was eliminated early in the planning process.

Modification of Siscowit Reservoir to provide flood control storage for the equivalent of 6 inches of runoff would require a new structure approximately 900 feet upstream of the existing dam. The drainage area is 3.4 square miles, only 10 percent of the total Rippowam River Basin area.

Modification of Siscowit Reservoir would be less effective than the Laurel and North Stamford modification plan in reducing flood flows in the major damage reaches. Significant residual flooding would continue to occur during major floods. The estimated first cost of modifying Siscowit Reservoir to provide flood control storage would be $7,900,000. With very limited flood damage reduction benefits the benefit to cost ratio would be 0.6 to 1.

Two new reservoir sites were considered for flood control. These two sites and four other sites were originally investigated by the Corps in 1956. None of the sites were economically justified at the time; however, two sites had potential. The features used in the current investigation are basically the same as the 1956 study except for an increase in number of dwelling relocations required and the increased construction costs.

Both new reservoir sites lie within the town of New Canaan and the city of Stamford, Connecticut downstream of the Laurel Reservoir Dam.

The level of protection provided by each reservoir would be approximately 90 percent as effective in stage reduction as compared to that offered by the raising of Laurel and North Stamford Reservoirs.

The first costs of construction of first and second reservoir sites are $39,000,000 and $34,100,000, respectively. With only limited flood control benefits the benefit to cost ratio would be 0.4 to 1 and 0.5 and 1, respectively. Both sites lack economic justification and would result in major environmental and social impacts. Because of these reasons and major public opposition these plans were eliminated from further study early in the planning process.

The operation of the existing system of water supply reservoirs to allow additional space for flood control was investigated. The objective of studying this measure was to develop reservoir guide curves which would permit flood control storage without infringing on the dependable water supply yield of the system. The results indicated that flood control storage could be assured only seasonally without affecting water supply yield, but storage equivalent to 4 inches of runoff could be provided during October through January. Under present conditions the guide curve could be applied at Laurel Reservoir, but if Siscowit was enlarged for water supply as planned then both Siscowit and North Stamford Reservoirs could be operated to assure seasonal flood control storage.

In order to accomplish this plan the outlet capacity of North Stamford Reservoir would be increased for effective storage regulation, and flashboards at North Stamford and Laurel Reservoirs would be replaced with leaf gates that would gradually lower automatically with increasing levels of overtopping surcharge.

Due to economic infeasibility, major negative environmental impacts and public opposition the concepts of modifying upstream reservoirs or construction of new reservoirs for flood control storage was eliminated early in the plan formulation process. The concept of operating the existing system of reservoirs for seasonal flood control was found to be a beneficial measure which by itself would not make major contributions to reduce downstream flooding but and could be valuable in combination with other measures in an overall flood protection plan.

Improve the Channel Capacity - Improving the channel flow capacity would be a local protection measure confined to Stamford in the major damage reaches from Pulaski Street Bridge to Cold Spring Road Bridge, a river length of about 9500 feet. Two approaches were taken to improve channel capacity: channel enlargement and removal of specific natural and man-made obstructions to flow.

Two channel enlargement plans were investigated which call for the deepening and widening of the Rippowam River channel between the Main Street Dam and Cold Spring Road Bridge. The objective of the first plan was to provide as much capacity as possible without requiring significant property acquisition adjacent to the river. The objective of the second enlargement plan was to construct a channel which would have full 100-year flood flow capacity.

Common to both plans is the modification of the Main Street dam with a bottom hinged control gate and the maintenance of the concrete walled channel containing Mill Pond upstream of the dam. Also common to both enlargement plans is the use of a rectangular concrete walled channel section, a slightly lower invert profile and the replacement of five bridges with non-restricting structures.

The first plan requires a channel width of 95 feet from Broad Street Bridge to Bridge Street Bridge and a width of 75 feet from Bridge Street Bridge to Cold Spring Road Bridge, the upstream limit of channel work. The second plan would use a channel width of 120 feet for the entire length of the project.

The first channel enlargement plan would have an estimated first cost of construction of $19,500,000. Although this measure would provide flood damage reduction benefits they would be limited due to high residual losses. By limiting the channel width in this plan, substantial residual flooding would continue to occur with a 100-year flood plain of over 80 acres. The benefit to cost ratio for this plan would be 0.8 to 1.

The second enlargement plan would have sufficient capacity to carry the 100-year flow. In most reaches of the river the channel width would be approximately 25 feet wider than the first enlargement plan. This additional width would require about 60 real estate relocations.

Due to major losses to fish and wildlife habitat, mitigation is required. Approximately 11.5 acres of riparian and about 20.5 acres of water based habitat would be lost by construction of this plan. The most feasible site for mitigation is located upstream from the project where the river is in relatively natural condition. Because the riparian and stream habitat already maintains fish and wildlife populations, the mitigation process would consist of intensive management measures to provide for a fish and wildlife population increase in the area. In order to accomplish this management program, approximately 23 to 25 acres of riparian habitat would have to be acquired. Approximately 40 acres of stream would have to be managed.

The total first cost of this plan without costs for upstream mitigation would be $29,000,000 and the benefit to cost ratio equal to 0.85 to 1. Due to lack of economic justification, major negative environmental impacts and strong public opposition both channel enlargement plans were eliminated from consideration during the second iteration of the plan formulation process.

Another approach to improve channel capacity is the removal of natural and man-made obstructions to flow. This measure would follow the features of the channel enlargement plan except for in-channel modifications and would include the replacement of flow restricting bridges at North Street, Bridge Street and Cold Spring Road and the modification of the Main Street dam with a bottom hinged gate control structure.

The estimated first cost of this channel capacity improvement measure is $4,032,000. Although flooding would still result in substantial residual losses with this measure, it is highly efficient in reducing flood damages and has a resultant benefit to cost ratio of 1.7 to 1. When combined with other measures this approach can make positive contributions to a comprehensive flood damage reduction plan. Such a combination with other measures is presented later in this section.

Confine the Flow - Levees and Floodwalls -The confining of flows to the river by levees and concrete floodwalls was investigated and could provide a high level of protection for the most flood prone areas in Stamford. This plan, based on a similar plan developed in 1963 by the State of Connecticut, was selected for study as it provided an extremely high level of protection appropriate for highly developed urban areas.

The plan would provide protection in Stamford from Pulaski Street to just upstream of Cold Spring Road. Levees would be built on 65 percent of the project bank length. The remaining 35 percent of the bank length would consist of concrete flood wall protection, and would be placed in reaches where there are existing concrete walls or where buildings or other structures are located close to the banks of the river and where the cost of property acquisition for levees would be prohibitive. Seven bridges would be replaced to accommodate the design flow. The streambed in some areas would be excavated to lower the water surface under bridge crossings.

The plan is hydraulically undesirable, in that, the confining levees and walls would cause increased stages in the river and extensive provisions for interior drainage would be required. Toilsome Brook, with a drainage area of about 1.6 square miles, drains to the Rippowam River within the flood prone reach and its flow would have to be pumped to the river or placed in a pressure conduit that would have to be over 2,000 feet in length through a highly developed area.

The construction of levees and floodwalls would result in substantial losses in water and riparian habitat. As in the case of the channel enlargement measures, mitigation by acquisition of similar habitat upstream of the project area would be required.

The estimated first cost of construction of the levee and floodwall measure would be $32,000,000. Although this measure provides a high degree of flood protection its high cost results in a benefit to cost ratio of 0.2 to 1. Due to lack of economic justification, significant negative environmental impacts, impacts on the citys' greenbelt plan and major public opposition, the levee and floodwall measure was eliminated from further consideration.

Bypass Flow to Avoid Damage Area - The measure of bypassing flow to avoid damage areas by means of deep rock tunnels was studied using four alignments. Each alignment would consist of an entrance structure and

vertical shaft leading to an underground tunnel bored in rock then returning to the surface through a vertical shaft and an outlet structure. In order to insure adequate rock cover above the main tunnel, it would be over 100 feet below ground surface.

During the design flood event the inlet structure would divert all flow in excess of downstream river capacity to the tunnel. The tunnel flow would return to the river downstream of the damage areas.

One plan, plan (C) would control flood flows in just the six reaches in Stamford between the mouth and its entrance upstream of Cold Spring Road at Stillwater Pond. This 9300 foot long 20 foot diameter tunnel would provide 100 year flood protection in the most flood prone reaches of the river when combined with minor protection measures in the reach between the tunnel outlet and Pulaski Street Bridge. These measures could consist of minor channel enlargement and the construction of concrete walls to protect senior citizens housing just upstream of Pulaski Street on the right bank.

During intermediate planning studies subsurface investigations were accomplished along alignment C. The results showed that there was a major drop in the rock profile near the inlet shaft which required the tunnel profile to be lowered. The added cost of this modification combined with increases in the cost of constructing tunnels resulted in a total construction cost of $40.4 million. During the same period there was not a corresponding increase in potential flood damages prevented. The result was a benefit to cost ratio of 0.4 to 1.

Although strongly supported by State and local officials bypass tunnels were dropped from further investigation due to lack of economic justification.

Measures to Modify Flood Damage Susceptibility

Measures in this category reduce or avoid flood damage by nonstructural means rather than change the regime of the river, its tributaries or its flood plain.

Flood Proofing - Flood proofing as used here is defined in the broadest sense and includes permanent flood proofing, permanent raising of structures and/or their contents, and permanent walls or barriers around individual or small groups of structures.

Flood proofing was studied early in plan formulation as a means of protection in the residual flood plain associated with the limited channel enlargement plan described previously. The analysis was based on field investigation of 126 structures located within the 84 acre 100-year residual flood plain. Because the channel enlargement measure was not economically feasible on a first-added basis, further study of flood proofing as a major flood damage reduction measure was discontinued.

The public has opposed flood proofing of individual structures on a large scale, since flooding would still cause major disruption. However, it was retained for small scale use in combination with other measures. If flood proofing is proposed as part of an overall plan, it must be combined with flood forecast, warning and evacuation measures since structures flood proofed may not be safe for habitation during flood events.

Forecast, Warn and Evacuate - Flood forecasting, warning and evacuation is a measure to reduce flood losses by charting out a plan of action to respond to a flood threat. The emphasis of this measure is protection of the life and safety of flood plain inhabitants. Some flood damage reduction may be realized in cases where property is portable and there is adequate time to move or protect it. The city of Stamford is implementing such a plan as described previously.

Control Development in the Flood Plain - The objective of measures in this category is to manage the flood plain to insure that its uses are compatible with the flood hazard. Control of development would be implemented by local communities, through regulations and policies and within the framework of State laws. Measures which control development include regulation of land use, building and housing codes and public acquisition of flood plain lands. Measures in this category are required when a community joins the National Flood Insurance Program as a condition of insurance availability.

Regulation of land use can be accomplished by two major approaches: zoning and subdivision regulations. Zoning can be used to restrict areas to particular uses, specify where the uses may be located and establish minimum elevations or flood proofing requirements for the uses. Subdivision regulations guide development at specific locations. If a subdivision is located in a flood prone area, the local community may require that special conditions must be met prior to development.

Regulation of land use should comply with State flood plain management regulations such as Connecticut's Inland Wetlands and Water Courses Act, the Stream Channel Encroachment Line Program, Coastline Structures and Dredging, Tidal Wetlands and the Coastal Management Act.

Implementation of land use regulation measures insure that changes in land use are compatible with the flood hazard whether or not there are other flood protection measures in effect. This measure, therefore, is carried forward for consideration with emphasis on future flood plain management.

Use of building and housing codes is another method that local communities have to control development in a flood plain. Building codes neither regulate where development takes place nor the type of development but rather building design and materials. The emphasis here is to insure that building codes include requirements for safety in flood hazard areas.

Flood proofing requirements may be required. Housing codes set minimum standards for construction and also set minimum standards for maintenance of structures. These codes can be used to require repair of damaged structures to assure the safety of occupants.

Another approach to controlling flood plain use is public acquisition of flood plain land. Acquisition is commonly of two types: acquisition of full fee title and acquisition of land use easement. Acquisition by full fee title puts property into public hands for public uses which are compatible with the flood hazard. Acquisition of land use easements restricts the use of privately owned land so that it is compatible with the flood hazard. Both types of acquisition need not be immediate but may be implemented gradually over time.

In its greenbelt proposal, the city of Stamford recommends both acquisition approaches for implementation of that plan. Much of the proposed greenbelt land lies within the existing 100-year flood plain. Because the proposed open space plan is a compatible use for a flood plain it is a valuable multi-purpose project.

Acquisition measures were not studied in detail. Large scale acquisition for flood protection would not be feasible in the highly urbanized damage reaches. Although damages are high, first floor flooding is not frequent enough to justify a large scale acquisition plan. Acquisition of individual structures would be considered in combination with other measures depending on its economic feasibility.

All of the measures in the category of controlling development in the flood plain must be carried out within the framework of Federal, State and local laws. These measures should be an integral part of any flood protection plan because they limit uses of residual flood plains, protect natural storage areas and control encroachment in undeveloped flood plains. For these reasons, control of development in flood plains should be a part of any comprehensive flood damage reduction plan.

Mitigate Suffering from Damage Accepted

In this category emphasis is not to protect property but compensate for flood losses through flood insurance or emergency assistance at the time of the flood.

Flood Insurance - Flood insurance does not directly reduce flood damage to either existing or future development but rather indemnifies a policy holder for financial losses suffered during a flood. It is a measure which individual property owners may use to "solve" a flood problem.

All communities in the Rippowam River Basin participate in the National Flood Insurance program. Stamford, New Canaan and Ridgefield, Connecticut participate in the regular phase of the programs whereas Pound Ridge and Lewisboro, New York, participate in the emergency phase.

Although flood insurance is a without-project condition, it is compatible with other flood damage reduction measures and should be incorporated into any recommended overall plan. Flood insurance also provides some relief for those who reside outside of the major flood damage zones and where other measures may not be feasible. In areas where other measures reduce flood stages, flood insurance premiums may be reduced.

Assist in Flood Emergencies - Assisting in flood emergencies includes organization for flood fighting, rescue operations, temporary flood proofing, erection of temporary earthen or sandbag dikes and similar actions.

Because the Rippowam River is a flash flood stream, traditional large scale flood fight operations are neither practical nor feasible.

For these reasons, assisting in flood emergencies was eliminated from further study, however, some measures such as temporary floodproofing would be recommended as part of a flood forecasting, warning and evacuation plan.

Accept the Damage

Acceptance of recurring flood damages would not meet the objectives of this study in that it is equivalent to the without project condition. The public is unwilling to accept periodic flood damage or the threat of increased future flooding.

Combinations of Measures

While all feasible measures described in this section would reduce flood damage, none provides a high level at protection plan by itself. Combinations of feasible measures were considered in formulating a complete flood damage reduction plan.

Channel improvements (removal of obstructions) and flood proofing were considered with the channel measure first and flood proofing last. Channel obstructions have historically been a major cause of flooding due to inadequate capacity and debris jams. The residual flood plain would be protected by flood proofing.

Non-competitive measures are also combined with the channel and flood proofing measures to form a comprehensive plan. These non-competitive measures are: Control of Land Runoff, Optimize Operation of the Existing Reservoirs, Forecasting Warning and Emergency Evaucation, Controlling Development in the Flood Plain and Flood Insurance.

The resultant plan which is presented in detail in the Detailed Project Report is primarily nonstructural and provides flood damage reduction benefits throughout the Rippowam River Basin.

ASSESSMENT AND EVALUATION OF COMBINATION PLAN

The results of preliminary plan formulation indicate that no single measure can be considered as a feasible comprehensive plan for flood damage reduction. In order to meet the primary objective of the study, reduce flood damages, it is necessary to formulate a plan which combines economically feasible and compatible measures. Furthermore, selected measures should be the most efficient in reducing flood damage in specific problem areas.

In this section a combination plan is formulated and presented in detail. This approach is considered to be the only feasible plan remaining for consideration.

Description

Seven feasible measures evolved during preliminary plan formulation: Removal of Channel Obstructions, Flood proofing, Flood Forecasting, Warning and Evacuation, Optimal operation of Upstream Reservoirs, Flood Insurance, Control of Future Development in flood plains and Control of Land Runoff. A plan composed of these measures would be primarily non-structural and includes construction, regulatory and operational features.

1. Modify Main Street Dam with Gate Control Structure - A portion of the existing 5 foot high, 140 foot long concrete dam, located about 330 feet upstream of the Main Street Bridge, would be modified to provide an opening to be equipped with a 5-foot high by 80-foot long bottom hinged gate. The top elevation of the new structure with the gate in the closed position would be equal to the existing structure (12 feet NGVD). In the closed position, the gate would maintain Mill Pond at its existing level under normal flow conditions. In the event of a flood, the gate could be lowered to elevation 7.5 NGVD providing an 80-foot long overflow section at that elevation. After the flood the gate would be raised to maintain the desired water level in Mill Pond. The total first cost of the feature is $826,000. During a 100-year flood the peak in Mill Pond will be reduced by about 2.3 feet.

It is recommended that the gate be operated in response to the proposed Flood Forecast and Warning System so that both upstream and downstream reaches are protected to the fullest extent possible.

Economic Evaluation of Modifications to Main Street Dam

Total First Project Cost	$826,000
Estimated Annual Cost	72,200
Estimated Annual Benefits	172,700
Benefit to Cost Ratio	2.4 to 1

2. Replace Bridges at North Street, Bridge Street, and Cold Spring Road - The three existing bridges have hydraulically restrictive openings to flood flows and would be removed and replaced with new more efficient structures. The new bridges would provide about 100-year flood flow capacity without significant backwater effect. Since the new bridges would be single span there would be no piers to trap debris.

The abutments and other foundation features of the bridges would be constructed to allow for enlargement of the river channel in the future without further major modification to the bridge. The selected widths are those used for the channel enlargement measure investigated in preliminary plan formulation.

The bridge superstructure would be standard steel and concrete and would be set high enough such that no part of it would be less than one-foot above the 100 year flood water surface. The superstructure includes all beams, girders, deck, railing and utilities beneath the bridges.

Since the decks of the new bridges would be higher than that of the existing bridges, the roadway profiles approaching them would be modified. These changes include modification to curbs, sidewalks, intersections with other street and driveways and utilities.

Performance of Bridge Replacements

100-year Flood Event

	Flood Stage of Existing Bridge (feet above NGVD)	Flood Stage with Proposed Bridge (feet above NGVD)	Reduction in Stage (feet)
North Street	25.7	22.1	3.7
Bridge Street	33.9	30.2	3.7
Cold Spring Road	41.9	33.7	5.2

Economic Evaluation of Bridge Replacements

	Total First Project Cost ($000)	Est. Annual Cost ($000)	Est. Annual Benefits ($000)	Benefit to Cost Ratio
North Street	$ 972.0	$ 79.0	$156.7	2.2
Bridge Street	1,585.0	129.0	85.6	0.7
Cold Spring Road	855.0	70.0	56.7	0.8
Total	$3,412.0	$278.0	$299.0	1.1

As shown above only the North Street Bridge replacement can be incrementally justified. The proposed bridge would have a clear span of 80 feet.

Flood Proofing - This measure was investigated to supplement the protection provided by the modification of Main Street Dam and the replacement of North Street bridge. Flood proofing of individual structures would also provide protection in areas which would not benefit from other measures.

Selection of flood proofing techniques was based on many factors including the type of structure, foundation, first floor and basement elevations, use, surrounding ground elevations and flood stages. Three flood proofing techniques were intially considered; move utilities from basement to first floor, raise structures so that first floor is above flood stage, and construct small floodwalls around structures or groups of structures. Acquisition of property was also considered.

In determining the feasiblity of flood proofing, the flood stages which include the reductions from the replacement of Main Street Dam and North Street Bridge were used. Because the replacements would not reduce flood damages in Reach 1 and Reaches 4, 5 and 6 a wide range of flood proofing techniques were examined where they appeared to be applicable. In Reach 1, raising utilities was evaluated for 21 residential structures. Acquisition of 8 of the 21 residences was also considered as well as construction of floodwalls around elderly housing units. It was determined that in Reach 1, flooding was not severe and/or frequent enough to justify the costs of flood proofing residential properties. Flood proofing of several commercial structures in Reach 1 was investigated and showed that only 1 or 2 isolated structures on West Main Street could be justified. Because structures in Reaches 2A, 2B and 3 would receive some protection from the dam and bridge replacement, raising of utilities was felt to be the only suitable flood proofing measure. Flood proofing was evaluated for about 88 residential structures including some multiple family dwellings. As in Reach 1, flooding is not severe and/or frequent enough to justify the costs of flood proofing.

In Reaches 4, 5 and 6 flood proofing and acquisition were investigated. Only those homes with first floors below the 100-year flood level were considered for acquisition. Acquisition was found to be unjustified primarily due to high real estate costs and low freuqency of damages. Therefore, utility relocation was considered as the primary flood proofing measure. Closures and low floodwalls were considered for ground level apartment and condominium units. None of the flood proofing measures in Reaches 4, 5 and 6 were economically justified.

In summary, 1 or 2 commercial structures in Reach 1 showed economic feasibility for flood proofing. These particular structures are located in a zone slated for future greenbelt acquisition and in an area in which major development changes may take place in the near future with or without a project. It is not in the Federal interest to flood proof individual isolated structures or structures which face major future changes. Therefore, flood proofing was dropped from the plan.

Flood Forecasting, Warning and Emergency Evacuation System - The city's system described previously is presented as a measure in this combination plan since it would be an integral part of any flood damage reduction program. This measure provides advance information for operating structural features such as the proposed gate at Main Street dam and non-structural measures such as flood proofing by individuals.

The city of Stamford would issue the flood warnings throughout the flood plain through a combination of radio announcements, door-to-door warnings, telephone warnings and other means to announce the situation and describe the appropriate course of action.

The evacuation phase of the plan would be pre-planned by city officials so that all citizens and responsible city officials fully understand the plan, the evacuation routes and the shelters to assure that everyone is prepared at all times to act accordingly.

Since the time periods between forecasting, warning and evacuation are short, 2 to 6 hours, the methods used to warn the public are limited. This situation makes it imperative that the city of Stamford maintain a state of readiness through periodic testing, public education and drills which include post-flood cleanup and reestablishment of the community.

Optimal Operation of Upstream Reservoirs - Existing water supply reservoirs can be operated to provide seasonal flood control storage while not infringing on the dependable water supply yield. This plan would not prevent major flood damage but could contribute to reducing the frequency of moderate floods. The effectiveness of this measure would be greatly increased if the proposed Siscowit water supply dam is constructed. If the Siscowit reservoir is constructed by non-Federal interests the city of Stamford could implement this plan in cooperation with the Stamford Water Company.

Flood Insurance - Since flood insurance is in effect in all communities in the basin it is recommended that it be continued and its requirements strictly adhered to. Flood insurance is a primary measure in those areas of the river basin which will not receive the benefit of other measures of the proposed plan or in those locations where the protection provided is less than 100-year. Those properties having no direct flood protection through other measures will have no change in flood insurance premiums. Those properties receiving less than 100-year protection may realize some reduction in their premiums. Properties which will be protected from 100-year flooding will have greatly reduced premiums.

Control Future Development in Flood Plains - This measure is included to prevent future encroachment on flood plains and to, preserves natural flood storage areas. No Federal action is recommended since this measure is within the jurisdiction of local and State regulation. Implementation of this measure should be consistent with FEMA guidelines relative to the requirements of the Flood Insurance program.

Control of Land Runoff - This measure is included in the plan to control development in such a way that new structures, parking lots, etc. do not induce higher flood stages or volumes. Existing regulations in Stamford should be strengthened if necessary. Enforcement action may be necessary to insure compliance.

RATIONALE FOR SELECTION OF FINAL PLAN

The selection of a plan is based on public desires, economic efficiency, environmental effects and other evaluation criteria. The combination plan presented in the previous section is the selected plan being the only plan available which is economically feasible and which maximizes net flood damage reduction benefits. The selected plan meets the primary objectives of the study without significant adverse environmental or social impacts. The selected plan is supported by the public and includes major commitments by local interests including financial, regulatory and planning. Such a commitment by local interests assures its implementation, and continuing operation and maintenance.

The selected plan reasonably maximizes net national economic development benefits and is, therefore, designated the National Economic Development (NED) Plan.

Because the selected plan is within the limitations of the small flood control authority (Section 205) it has been recommended that implementation of the plan be authorized by the Chief of Engineers. As recommended this plan addresses the problem and opportunity statements.

SELECTED PLAN

PLAN DESCRIPTION

The combination plan, composed of feasible measures described in the previous section, and shown on Figures 4 and 5 is the selected plan. The plan is composed of the modification of Main Street Dam, replacement of North Street Bridge and additional nonstructural measures is the most efficient combination of measures available for implementation. Detailed description, analysis, and evaluation of this plan is presented in the Detailed Project Report.

PLAN ACCOMPLISHMENTS

The selected plan will reduce flood damages in the study area with minimal adverse impacts. A recurrence of the October 1955 flood with the selected plan in operation would cause $16,513,000 in damage, a reduction of $9,874,000 over the existing conditions. On an annual basis the total benefits amount to $300,700 . In addition to economic benefits are the benefits of security. The city's flood forecast warning and emergency evacuation plan provides relief from threat of frequent flooding particularly in the reach between Bridge Street bridge and upstream of Cold Spring Road. Nondamaging water levels threaten almost annually while residents find themselves in a risk taking position with little warning time.

The plan is consistent and protective of the city's proposed greenbelt plan. Recreational use of bordering flood prone lands is a compatible use and prevents unwise development while preserving the river's valuable natural resources.

Flood insurance, control of future development and control of land runoff to be implemented by local interests provide long term protection from flood inducing development and preserves project features at their design level.

In the major business area between Main Street Dam and Bridge Street the gate control structure will provide complete 100-year flood protection and access to the commercial district.

SUMMARY OF PLAN EFFECTS

Economic Impacts

The estimated costs of the selected plan of improvement are shown below:

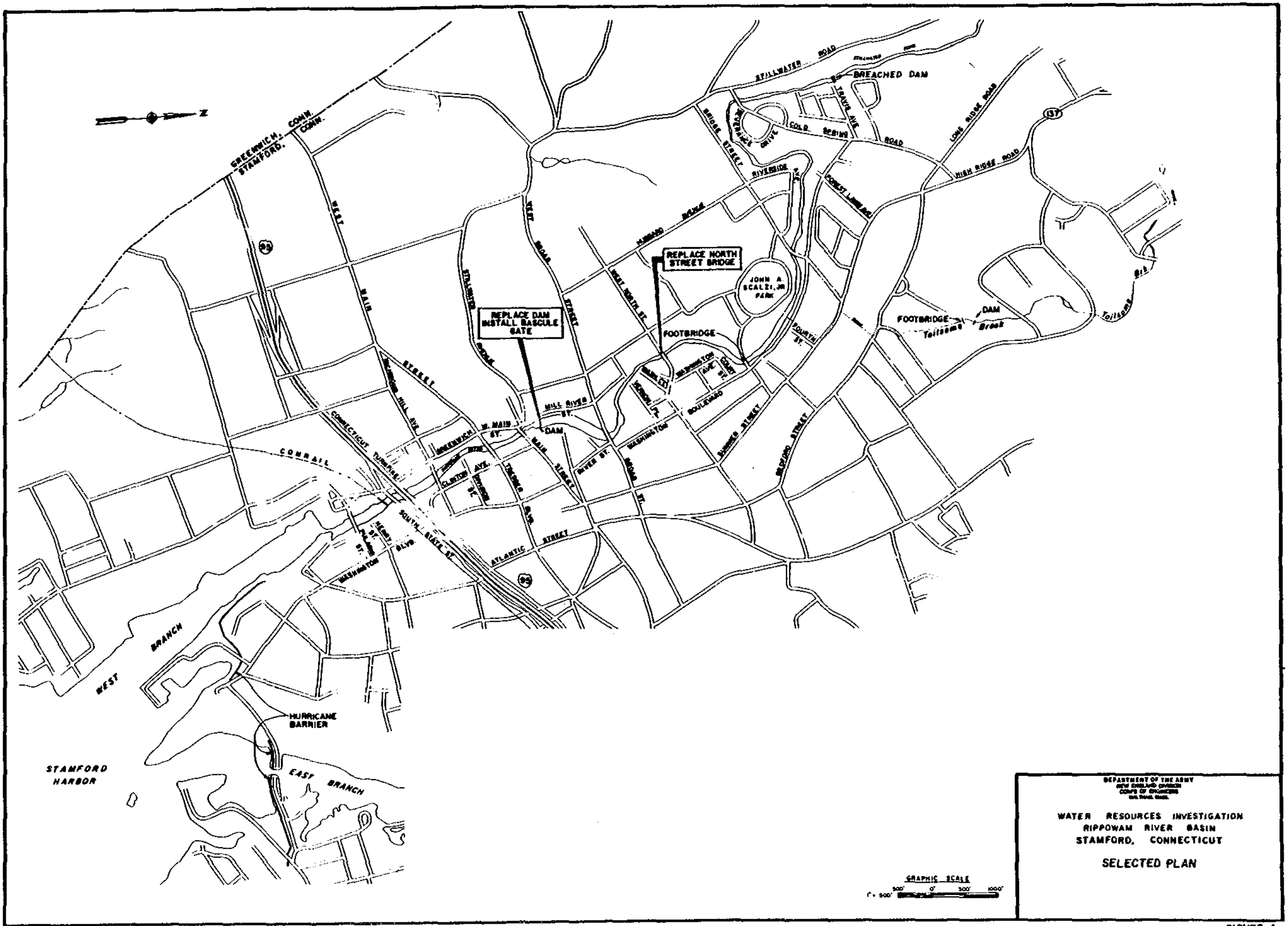
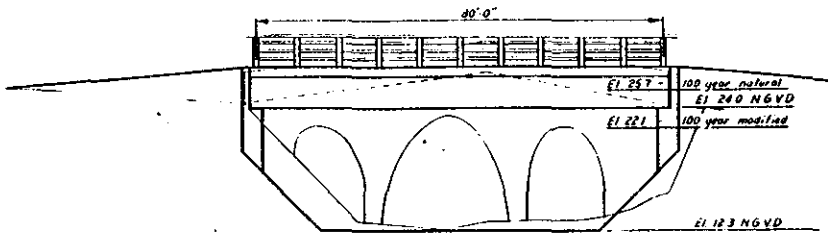
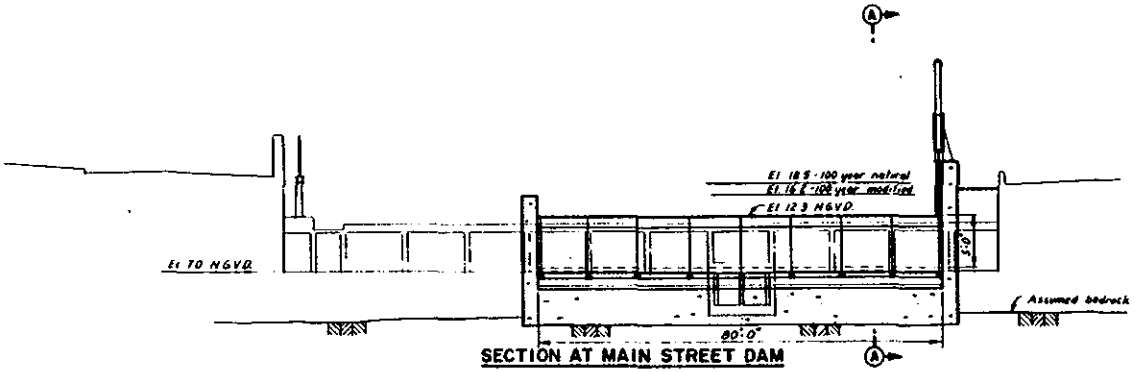

REPLACE DAM
INSTALL BASCULE GATE
REPLACE NORTH STREET BRIDGE
BREACHED DAM
DAM
FOOTBRIDGE
JOHN A. SCALZI, JR PARK
HURRICANE BARRIER
STAMFORD HARBOR
WEST BRANCH
EAST BRANCH
GREENWICH, CONN.
STAMFORD, CONN.
CONRAIL
STILLWATER ROAD
COLD SPRING ROAD
LONG RIDGE ROAD
HIGH RIDGE ROAD
BRIDGE STREET
RIVERSIDE AVE.
HUBBARD AVENUE
WEST BROAD STREET
WEST NORTH ST.
WEST MAIN STREET
MAIN STREET
MILL RIVER ST.
WASHINGTON BOULEVARD
SUMMER STREET
BEDFORD STREET
ATLANTIC STREET
CONNECTICUT TURNPIKE
SOUTH STATE ST.
Toilsome Brook
GRAPHIC SCALE
DEPARTMENT OF THE ARMY
WATER RESOURCES INVESTIGATION
RIPPOWAM RIVER BASIN
STAMFORD, CONNECTICUT
SELECTED PLAN

FIGURE 4



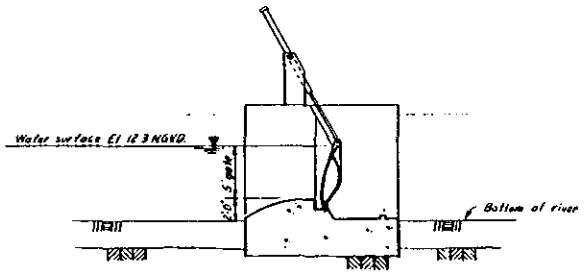
NORTH STREET BRIDGE

SCALE: HORI. 1" = 10'
VERT. 1" = 8'



SECTION AT MAIN STREET DAM

SCALE: HORI. 1" = 10'
VERT. 1" = 8'



SECTION A-A

SCALE: 1" = 8'

GRAPHIC SCALES

1" = 8' 0 5 10

1" = 10' 0 10 20

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

WATER RESOURCES INVESTIGATION
RIPPOWAM RIVER BASIN
STAMFORD, CONNECTICUT

SELECTED PLAN
SECTIONS

FIGURE 5

TABLE 7
SELECTED PLAN ESTIMATED FIRST COST 1/

Project Feature	Estimated Cost
Replace Main St. Dam	$ 826,000
Replace North St. Bridge	$ 972,000
TOTAL PROJECT FIRST COST	$1,798,000

1/ Costs include Engineering and Design and Supervision and Administration

Annual costs have been computed based on an interest rate of 8-1/8 percent and a 100-year project life. Interest during construction is based on an anticipated 1.5 year construction period.

TABLE 8
SELECTED PLAN ESTIMATED ANNUAL COSTS 1/

Item	Amount
First Cost	$1,798,000
Interest During Construction	109,000
Investment Cost	$1,907,000
Estimated Annual Costs:	
Investment	$155,000
Operation and Maintenance	1,500
TOTAL	$156,500

1/ June 1983 prices, amortized at 8-1/8%; 100-year life.

The selected plan of improvement to provide flood damage reduction for the Rippowam River in Stamford, Connecticut is economically justified as shown in Table 9.

TABLE 9

SELECTED PLAN SUMMARY OF ECONOMIC ANALYSIS

Average Annual Benefits	$300,700
Average Annual Costs	$156,500
Benefit-cost Ratio	1.9 to 1

Environmental Impacts

Implementation of the selected plan would not result in significant environmental impacts. Detailed environmental impact study results may be found in the Detailed Project Report.

COST APPORTIONMENT

The apportionment of costs between Federal and non-Federal interests is based on current Federal legislation and administrative policies governing project planning for flood damage reduction and general recreation. Table 11 shows the cost apportionment between Federal and non-Federal interests. In general, local interests pay the cost of all lands, easements and rights-of-way, utility relocations and alterations, and all alterations of highway bridges necessary for the purpose of flood damage reduction. Operation and maintenance of the project after implementation is also a non-Federal responsibility. All remaining project costs are allocated to the United States.

Table 11

SELECTED PLAN COST APPORTIONMENT

Project Feature	Federal	Non-Federal	Total
First Costs			
Modify Main St. Dam	$826,000	0	$826,000
Replace North St. Bridge	$0	$972,000	$972,000
TOTAL FIRST COST	$826,000 (46%)	$972,000 (54%)	$1,798,000 (100%)
Operation and Maintenance			
TOTAL AVERAGE ANNUAL	0	$1,500	$1,500

PUBLIC REVIEW COMMENTS

Summarized in this section are the comments received during the public review period for the Detailed Project Report for Local Flood Protection in Stamford. The review period began on 19 April 1984 and followed the requirements of Executive Order 12372, Intergovernmental Review of Federal Programs, for the State review process. Copies of correspondence received may be found in the Appendix.

Other Federal Agencies

Environemtnal Protection Agency; Region 1, the U. S. Fish and Wildlife Service and the National Marine Fisheries Service presented three issues regarding the construction of the local protection project: (1) consideration should be given to fish passage through the Main Street Dam; (2) construction period restrictions to avoid fish spawning and migration periods; (3) concern for the quality of sediments upstream of the Main Street Dam.

State of Connecticut

The Connecticut Department of Environmental Protection found that a complete range of alternatives was investigated and supports the proposed local protection plan. This agency also requests that a fishway be provided in the Main Street Dam in accordance with State statutes. The Connecticut Historic Preservation Officer request that the Corps seek a determination of eligibility, to the National Register of Historic Places, for the North Street Bridge, the Main Street Lenticular Bridge and the Stillwater Dam and Factory Archeological Complex.

City of Stamford

The city's Environmental Protection Board concurs with State and Federal resource agencies in the need to provide a fish passage at Main Street Dam. The mayor, through his letter of intent, supports the project and agrees to meet the local assurances requirements.

Other Comments

The only comment from non-governmental parties came from the Conservationists of Stamford which supports the proposed local protection project.

CONCLUSIONS

The water resources study of the Rippowam River Basin has shown that the primary problem in the basin is flood damages. Basin solutions to the flood problem were found to be economically infeasible. Local flood protection measures located in the flood prone areas of Stamford were found to be feasible and have been recommended for implementation through the small flood control program (Section 205) within the authority of the Chief of Engineers.

Implementation of the local flood protection plan as recommended in the Detailed Project Report, Local flood Protection, Rippowam River, Stamford, Connecticut, brings together Federal and non-Federal resources to solve the flood problem in the most efficient manner.

Other water resources problems and opportunitites are being addressed by other agencies. Protection and enhancement of the aesthetic attributes of the Rippowam River will be accomplished by the proposed local protection plan in combination with Stamford's proposed Greenbelt plan. The water quality of the river is under the protection of local and State regulations. There are no serious water quality problems at this time. Fish and wildlife remain an important resource within the basin. Planned water resources developments should not adversely impact fish and wildlife habitat. The proposed small flood control project in combination with the Stamford's greenbelt plan should enhance habitat in the lower 2 miles of the river.

It may be concluded that aside from the local protection project being proposed through a separate authority that there are no other water resuorces problems or opportunities which warrant Federal action, planning, or implementation at this time. Furthermore, this feasibility study provides the State and local communities within the basin the data and analysis that may be helpful in their planning activities as they relate to water resources.

RECOMMENDATIONS

I have reviewed and evaluated in light of the overall public interest the documents pertaining to the alternatives investigated in this feasibility study and the selected plan for flood damage reduction along the Rippowam River, Connecticut and New York being recommended for implementation through the Special Continuity Authority program. The views and comments of other agencies and the general public have also been reviewed and considered. I have given consideration to the environmental, social and economic consequences and the engineering feasibility of all the alternatives investigated on both a regional and a national basis.

I recommend that since water resources objectives for the Rippowam River Basin can be addressed through the Continuing Authority Program of Section 205 P.L. 858 as amended, that no specific Congressional authorization is required to implement a Federal project.

25 Sept 1984
DATE

Edward D. Hammond
Major (P), Corps of Engineers
Acting Division Engineer

APPENDIX A

PUBLIC INVOLVEMENT

APPENDIX A

PUBLIC INVOLVEMENT

STAGES IN THE PUBLIC INVOLVEMENT PROCESS

A three-stage process was used in the initial basin-wide study with corresponding stages used in the public involvement process. Emphasis during Stage 1, from 1976 to 1979 was to inform the public of the Corps' role in water resources development and develop a plan of study. During Stage 2; from 1979 to 1980, emphasis was on displaying and analyzing all alternatives available to solve identified water resources problems and needs. Those plans which were more feasible and publically acceptable were carried into Stage 3. Emphasis during Stage 3, from 1980 to 1983 was on selecting and evaluating a plan from feasible alternatives which were analyzed in detail.

The following sections summarize the three stages and the key events, meetings and publications which were part of the public involvement process. Copies of the publications and pertinent public involvement reports are included in the supporting documentation for this report.

STAGE 1 - PUBLIC INVOLVEMENT

The study was officially initiated by a public meeting announcement dated 26 April 1976. The Stage 1 public meeting was held in Stamford on 24 May 1976. Other meetings where held during Stage 1 with Stamford officials and with Connecticut Department of Environmental Protection to obtain all available data applicable to the Rippowam River Basin.

The objective of public involvement during Stage 1 was to develop lines of communication, describe the Corps' authority, obtain data and scope the study. The public notice and public meeting met those objectives. The consensus of opinion showed a high level of concern for the flood problem, particularly in the reach between Bridge Street nad Cold Spring Road. There was concern that development in the area was aggravating the flood problem and should be controlled. Another major concern centered around the natural value of the river and the need to protect its water quality, recreational and open spare values.

STAGE 2 - PUBLIC INVOLVEMENT

Stage 2 was initiated by participating in several meetings with Stamford officials early in 1979. A public announcement of the Stage 2 public meeting was issued in May 1979. The objective of public involvement during Stage 2 was to: display the alternative plans available to them which would meet the objectives of the study, describe the economic feasibility and impacts of each plan, to obtain feedback from the public and to select those plans which warrant more detailed study.

The public meeting in May 1979 was a major form for displaying 13 alternative plans for flood damage reduction. The public response at the meeting and through written communications indicated the public's desire to study five plans in detail: Modify Siscowit Reservoir, Tunnel Bypass (Plan C), Channel Enlargement, Flood Forecast, Warning and Preparedness Planning, and Optimum Reservoir Operation.

STAGE 3 - PUBLIC INVOLVEMENT

Stage 3 public involvement dealt with detailed evaluation of the five alternatives chosen in Stage 2. A committee was formed composed of Stamford city officials, representatives from local interested groups and interested citizens. This committee of 11 met on several occasions. The objective of Stage 3 public involvement was to display the alternative plans studied in detail and to select a plan for recommendation. It was during this stage of the study, after workshops with the committee, that the bypass tunnel plan was found to be economically infeasible. At that point it was determined that the selected plan could be implemented through the continuing authority program. A meeting with the Mayor of Stamford and his staff was held in January 1984 to describe the plan, the Section 205 authority and cost sharing. The mayor supported the plan and agreed with shifting the study into the Section 205 authority. The public review of the Detailed Project Report began on 19 April 1984.

PERTINENT CORRESPONDENCE

The letters included in the following section were selected from the correspondence received since the initiation of the study which are pertinent to the study. Letters which specifically pertain to the proposed local protection project may be found in the Detailed Project Report.

PERTINENT CORRESPONDENCE

STATE OF NEW YORK
EXECUTIVE CHAMBER
ALBANY 12224

HUGH L. CAREY
GOVERNOR

April 26, 1976

Dear Colonel Mason:

Thank you for your letter advising us of a Corps of Engineers study of the Rippowam River Basin involving a portion of southeastern New York including the communities of Pound Ridge and Lewisboro.

We are pleased to hear this study of water and related land resources needs is being initiated and will provide any necessary State assistance through the Department of Environmental Conservation.

Sincerely,

Hugh L. Carey

Colonel John H. Mason
Division Engineer
New England Division,
Corps of Engineers
Department of the Army
424 Trapelo Road
Waltham, Massachusetts 02154

MAYOR
LOUIS A. CLAPES

PLANNING BOARD
JON A. SMITH, A.I.P.
PLANNING & ZONING DIRECTOR

CITY OF STAMFORD, CONNECTICUT 06901

July 20, 1976

Mr. F. William Swaine
Project Engineer
Department of the Army
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Re: Rippowam River Study
Stamford, Connecticut

Dear Mr. Swaine:

On May 24th, I presented Colonel Mason with a copy of a concept study for a MILL RIVER GREENBELT which will be featured in the soon to be completed up-dating of Stamford's Master Plan. I further testified that more than 40,000 people (40% of Stamford's population in 1970) lived within one mile of the river frontage. In the interim, we have had much favorable comment from the public and on June 15th, Mayor Clapes asked that I chair a committee to study the early implementation of public access to and use of the "Mill Pond Area". (see attachment)

One of the most obvious areas of potential would be the possibility for public boating, on the Mill Pond. The water is accessible by existing stairways built into the retaining walls on both sides of the pond. To make such a use possible would require dredging. This immediately raises the question of how much dredging would be required and what would be the implications of greater water pressure upon the existing dam if the pond is deepened.

The purpose of this letter, is not only to make you aware of current local events in connection with this concept, but also to solicit the assistance of your good office in securing the answers to the questions posed above.

Finally, although we appreciate such information would be forth-coming as an end product of your two-year study of the entire

Rippowam River Basin, can your exploration in the Broad Street to Main Street (Stamford) segment be accellerated so that we may have the information early so that we may proceed with a meaningful evaluation of the great potential of this natural amenity.

Your early response to this request would be appreciated.

Very truly yours,

Jon A. Smith
Planning & Zoning Director

JAS:rmb
cc: Mill Pond Committee
Mayor Louis A. Clapes

ELLA GRASSO
GOVERNOR

STATE OF CONNECTICUT
EXECUTIVE CHAMBERS
HARTFORD

December 2, 1976

Colonel Ralph T. Garver
Acting Division Engineer
U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Garver:

Thank you for your letter informing me that the Plan of Study Report for Water Resources Investigation of the Rippowam River Basin in Connecticut and New York has been approved by the Chief of Engineers.

My office has been informed that Mr. Benjamin A. Warner, flood control coordinator of the Connecticut Department of Environmental Protection was present at the initial public meeting on the Rippowam River Basin Study held May 24 and that he made a statement supporting the corps' proposed study.

The state is aware of the serious flooding problems in the highly urbanized areas of Stamford and welcomes a detailed study of these problems.

Needless to say, Mr. Warner and other staff of the Department of Environmental Protection will cooperate with the corps in the upcoming Stage II investigation of the Rippowam River Basin Study.

With best wishes,

Cordially,

Ella Grasso

ELLA GRASSO
Governor

TOWN OF NEW CANAAN
CONNECTICUT 06840

HENRY S. NOBLE
FIRST SELECTMAN

April 18, 1978

TELEPHONE
(203) 966-1687

Col. John P. Chandler
Corps of Engineers
Department of the Army
424 Trapelo Road
Waltham, Massachusetts.
02154

Dear Col. Chandler:

In response to your inquiry about the potential study of the Rippowam River basin as it affects New Canaan, it is our considered judgment that those steps necessary to preserve and protect the river basin in New Canaan are already being accomplished at the local level.

As you no doubt know, the Rippowam River flows from New Canaan into the reservoir of the Stamford Water Company and is a substantial supplier of potable water for that City. In 1956, the Town of New Canaan acted to protect the major watersheds in Town by adopting a new zoning classification requiring four acres of land for each house site in the basic watershed areas. This action was strongly supported by the various Water Companies.

In 1973, the Town appointed an Inland Wetlands and Water Courses Commission in accordance with the Connecticut General Statutes and that body zealously guards the swamps and streams such as the Rippowam from abuse.

The Town, through its professionally qualified Health Department, administers the State Health Code which has special provisions for septic systems in watershed areas.

The upper reaches of the Rippowam flow through privately held properties and there is little justification for any consideration of public recreational use of such a tiny stream. Private recreational use by the abutting owners is totally outside Town jurisdiction, except where it would violate the State Health Code.

Any serious problems involving the river would appear to lie below the various reservoirs, totally within the City of Stamford. It would, therefore, seem most logical for the major import of your study to concern itself with that area.

We appreciate your keeping us posted on your progress and trust the information we have supplied will be of assistance to you.

Sincerely,

Henry S. Noble
First Selectman

HSN:kh

STEWART B. MCKINNEY
4TH DISTRICT, CONNECTICUT

109 CANNON HOUSE OFFICE BUILDING

COMMITTEES:
BANKING, FINANCE AND URBAN AFFAIRS
DISTRICT OF COLUMBIA

TELEPHONE: (202) 225-5541

Congress of the United States
House of Representatives
Washington, D.C. 20515

DISTRICT OFFICES:
FEDERAL BUILDING
LAFAYETTE BOULEVARD
BRIDGEPORT, CONNECTICUT 06604
TELEPHONE: (203) 384-2256

800 SUMMER STREET
STAMFORD, CONNECTICUT 06901
TELEPHONE: (203) 357-8277

NORWALK, CONNECTICUT
TELEPHONE: (203) 846-6469

June 28, 1979

LtG. John W. Morris
Chief of Engineers
Department of the Army
Washington, D.C. 20314

Dear General Morris:

I would like to commend the Corps of Engineers on the excellent presentation and preparation of the New England Division for a hearing held recently in Stamford, Connecticut to present proposed solutions to the flooding of the Rippowam River.

I found, for the most part, the residents to be in a conciliatory mood, and I believe that this was because of an intense effort on behalf of the Corps to have an informed public. The public relations campaign, initiated by the Corps, was excellent, both in its radio and printed presentation. The brochure, attached, is clear and concise.

Such thorough presentation allows the constituency to feel that they are part of the solution which helps to allay the feelings of paranoia often seen in public hearings on any subject having to do with the Federal Government.

I am impressed.

Sincerely,

Stewart B. McKinney

STEWART B. MCKINNEY, M. C.

SBM/mjl

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
P.O. Box 1518
Concord, New Hampshire 03301

Ref: Planning Division (NED)

JUL 23 1979

Division Engineer
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Sir:

This letter has been prepared as a part of our continuing coordination efforts with the Rippowam River Basin Study in Stamford, Connecticut. This letter supplements our Planning Aid Letter of November 28, 1978, and represents our preliminary assessment and evaluation of alternatives supplied to this office on May 16, 1979, and presented at a public meeting on June 13, 1979. It is prepared and submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

We understand that four general types of alternatives are presently under study: nonstructural alternatives, reservoirs, tunnel diversions, and channel improvements.

Nonstructural Alternatives

We repeat our earlier recommendation (Planning Aid Letter of November 28, 1978) that the nonstructural alternatives of floodproofing, flood forecasting and warning, flood insurance, and optimum reservoir operation be the primary solution to the flood problem. These alternatives would have no negative impacts on the fish and wildlife resources.

Reservoirs

It is our understanding that raising Siscowit Reservoir for flood water storage and water supply is under serious consideration. At this time we do not have the data to address the impacts to fish and wildlife of this action. If this alternative is studied in greater detail, we will need additional information and funding to perform a Habitat Evaluation Procedures analysis. The implementation of this alternative would probably require mitigation measures for fish and wildlife.

Tunnel Diversions

Tunnel Diversion Plan C is the most environmentally sound structural alternative under study. This tunnel would permit the integrity of the river channel and riparian vegetation to be maintained. Minimum and maximum flows in the natural river channel would have to be established at a later design stage. Short-term construction impacts can be minimized by the use of erosion control devices.

Channel Improvements

The impacts of channel improvements (channelization, floodwalls and dikes) were discussed in our Planning Aid Letter of November 28, 1978. We repeat our recommendation that channelization should only be considered if no other practical alternatives exist. In this case there appears to be other practical alternatives to channel improvements and we would most likely oppose a project containing any channel enlargement.

We appreciate the opportunity to review and evaluate these alternatives. We request the opportunity to provide additional comments as the planning process continues and more detailed plans are developed.

Sincerely yours,

Gordon E. Beckett

Gordon E. Beckett
Supervisor

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

STATE OFFICE BUILDING HARTFORD, CONNECTICUT 06115

August 20, 1979

Colonel Max B. Scheider
U. S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Scheider:

On behalf of the Connecticut Department of Environmental Protection, I would like to commend your recent efforts to inform and involve the public in the Rippowam River Flood Study. In particular, the circular entitled "Flooding on the Rippowam River" is a clear, concise and informative presentation of flood problems, damages, financial arrangements and alternative flood control plans. Hopefully, this format may be transferred not only to other Corps projects, but to projects proposed by state, local and other federal agencies.

As far as comments on the specifics of the Rippowam Study, the State of Connecticut heartily endorses the concept of a mixed structural and non-structural project which would minimize environmental damage. However, it would be good if yearly and irregular maintenance costs for all projects could be provided so as to give the community one more factor for decision making. Also, it should be noted that, whatever alternate is selected, it will likely take more than three or four years before it can be completed. Hence, it is imperative that Stamford be informed of the need for creating or maintaining a good flood forecasting, warning, evacuation, disaster relief and insurance plan for the interim period.

Once again, our compliment on a well presented Stage Two Report.

Sincerely,

Benjamin A. Warner

Benjamin A. Warner
Director
Water Resources Unit

BAW/dr

Stamford Water Company
103 Summer Street, Stamford, Connecticut 06901

TEL. (203) 324-3163

December 9, 1980

William E. Hodgson, Jr., Colonel
Acting Division Engineer
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Colonel Hodgson:

I would like to comment on your letter dated November 25, 1980 regarding a flood control project for the Rippowam River Watershed, Stamford, Connecticut.

In your description of alternative #2, "By pass Tunnel with New Siscowit Reservoir," the implication is that by expanding the storage capacity of Siscowit Reservoir, additional flood protection would be provided upstream of Stillwater Pond. No mention is made of the expansion of storage capacity for additional water supply.

The expansion of our Siscowit site for future water supply has always been our intention and is presently being considered by your office in its Housatonic Urban Study. The coordination of your flood control and water supply efforts is essential to the proper evaluation of alternatives in both studies.

Very truly yours,

James McInerney
President
Stamford Water Company

JM:mh

United States Department of Agriculture
Soil Conservation Service
Mansfield Professional Park
Storrs, Connecticut 06268

December 22, 1980

Department of the Army
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

ATTN: Colonel William E. Hodgson, Jr.

Gentlemen:

We have reviewed the alternatives presented for the Rippowam River Watershed Flood Control Project in Stamford, Connecticut. Our major concern at this time would be the effects of construction activity in relation to erosion and sediment control needs of the river bottom and banks and its relation to offsite impacts.

We appreciate the opportunity to comment on the proposed project at this time and look forward to working on future projects together.

Sincerely,

Jack C. Davis
State Conservationist

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Services Division
Habitat Protection Branch
7 Pleasant Street
Gloucester, Massachusetts 01930

FEB 12 1981

Col. William E. Hodgson, Jr.
Acting Division Engineer
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Colonel Hodgson:

The National Marine Fisheries Service (NMFS) has reviewed the information request and discussion which accompanied your letters of November 25, 1980, and December 1, 1980, and Mr. Ignazio's letter of January 22, 1981, regarding the continuing planning effort for a flood control project in the Rippowam River Watershed at Stamford, Fairfield County, Connecticut.

There presently exist no fishery resources of concern to NMFS in the Rippowam River. Therefore, we have no comments to offer regarding the scoping process for the Environmental Impact Statement (EIS). However, because of the potential for adverse impacts to "downstream" resources we are convinced that alternatives which minimize "instream" alterations are preferable. The choices offered as alternatives in the letters indicate to us that channel enlargement with flood proofing is the least desirable while optimum reservoir control with flood forecasting, warning, and evacuation is the most desirable, followed closely by the high flow skimmer tunnel system.

Sincerely,

Ruth Rehfus

Ruth Rehfus
Acting Branch Chief

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
STATE OFFICE BUILDING HARTFORD, CONNECTICUT 06115

February 19, 1981

Colonel William E. Hodgson, Jr.
Acting Division Engineer
Corps of Engineers
Department of The Army
New England Division
424 Trapelo Road
Waltham, Massachusetts 02154

Re: NEDPL-1

Dear Colonel Hodgson:

In reviewing The Army Corps of Engineers' proposed plans for the Rippowam River project with the Fisheries Unit, no major objections were raised to any of the alternatives.

The only minor objection to this project would be to keep the extent of any stream channelization or enlargement to a minimum to avoid the potential loss of fish habitat.

Thank you for contacting us on this proposal.

Sincerely yours,

Dennis P. DeCarli
Deputy Commissioner
Conservation & Preservation

DPD:mm

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

November 25, 1981

Joseph L. Ignazio
Chief, Planning Division
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

Re: Rippowam River Basin Study
Rippowam River Flood Control Project

Dear Mr. Ignazio:

This is in response to your October 2nd letter requesting my views concerning possible measures to mitigate destruction of fish and wildlife habitat and permanent degradation of water quality anticipated with construction of the open channel alternative for flood control on the Rippowam River in Stamford, Connecticut. As you are aware, the U.S. Fish and Wildlife Service expressed their opinion on this subject in a September 8th letter to Colonel Hodgson. I concur with the Fish and Wildlife Service's views and add the following:

The hydraulic requirements for passing flood flows are frequently incompatible with on-site ecological mitigation. Hence the need for extensive upstream mitigation measures, as suggested by the Fish and Wildlife Service. It is likely that anticipated adverse impacts to water life and water quality within the channel project area itself can not be ameliorated. In view of the tunnel alternatives, the channelization presents unacceptable wildlife and water quality impacts.

Sincerely,

Stanley J. Pac
Commissioner

SJP/DC/dr

Phone:

State Office Building, Hartford, Connecticut 06115

United States Department of the Interior

FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
P.O. BOX 1518
CONCORD, NEW HAMPSHIRE 03301

MAY 4 1984

Mr. Joseph Ignazio
Chief, Planning Division
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Mr. Ignazio:

This is in response to your April 27, 1984, request for our review and comment on the Draft Detailed Project Report and Environmental Assessment for local flood protection on the Rippowam River, Stamford, Connecticut.

The present project proposal involves modification of Main Street Dam by the Corps, replacement of North Street Bridge by non-federal interests, and certain nonstructural flood protection measures including a flood warning and evacuation plan to be implemented by local interests.

Proposed modifications to the Main Street Dam include removing a 5-foot high by 80-foot long section of the 120-foot long by 5-foot high dam and replacing it with a bottom-hinged section of equal dimension. The hinged section would be lowered during flood events and kept in the raised position at other times to maintain the existing water elevation in Mill Pond.

During the course of this water resource investigation we raised questions concerning fish passage (Planning Aid Letter, September 3, 1980) at the Main Street Dam and quality of the sediments in Mill Pond (Planning Aid Letter, November 28, 1978). Neither of these issues appears to be addressed in the DPR.

Fish passage for alewife, blueback herring, eels, white perch, and possibly other species should be included in your plans to modify the Main Street Dam. This could be accomplished by removing the Main Street Dam completely, installing a fish ladder in the dam or designing the project such that the hinged gate or portions thereof would remain lowered during the fish migration and spawning season (May-June).

Information regarding the quality and volume of sediment trapped behind the Main Street Dam should be obtained prior to the completion of this study. If sediment has accumulated in Mill Pond,

it appears likely that the proposed modifications to Main Street Dam would allow this material to be flushed into Stamford Harbor adding to or creating maintenance dredging and disposal problems. Therefore, a sediment removal operation may be warranted for this project.

Time-of-year restrictions should be included in the DPR and subsequent plans and specifications to insure that construction activities do not interfere with fish migration and/or reproductive activities during the May 1-June 30 time period.

Please advise us on the action you propose to take regarding these issues identified above prior to completion of the final DPR. If you should have any questions regarding this matter, please feel free to contact Mr. Vern Lang at this office (FTS 834-4797).

Sincerely yours,

Gordon E. Beckett

Gordon E. Beckett
Supervisor
New England Field Office

Office of the
STATE
HISTORIC
PRESERVATION
OFFICER
for Connecticut

59 SOUTH PROSPECT STREET - HARTFORD, CONNECTICUT 06106 - TEL: (203) 566-3005

May 10, 1984

Mr. Horace H. Brown
Comprehensive Planning
Division
Office of Policy and
Management
80 Washington Street
Hartford, CT 06106-4459

Subject: Detailed Report and Environmental Assessment
Flood Protection, Rippowam River, Stamford, CT

Dear Mr. Brown:

The State Historic Preservation Office has reviewed the above-named document provided by the U.S. Army Corps of Engineers. This office has undertaken prior consultation with the U.S. Army Corps of Engineers with respect to an archaeological survey report entitled "Cultural Resource Reconnaissance: Rippowam River Basin Study, Stamford, Connecticut," prepared by Raber Associates concerning the project. We believe that several properties within or immediately adjacent to the project area may meet the eligibility criteria for the National Register of Historic Places.

We recommend that the U.S. Army Corps of Engineers request a determination of eligibility for: the North Street Bridge, the Main Street Lenticular Truss Bridge, and the Stillwater Dam and Factory Archaeological Complex. This request should be submitted to: Mr. Jerry Rogers, Keeper of the National Register, National Park Service, U.S. Department of the Interior, 100 L Street, N.W., Washington, DC 20240. In accordance with National Park Service guidelines, documentation should include a physical and historical description, a statement of significance, and photographs and maps. The enclosed Historical Commission inventory forms represent a suitable format for this documentation. We should receive a copy of the completed inventory forms so that the State Historic Preservation Officer may submit his formal opinion concerning the eligibility of these properties.

The State Historic Preservation Office understands that the proposed undertaking will have no effect upon the Main Street Lenticular Truss Bridge and the Stillwater Dam and Factory Archaeological Complex. All

design changes in relation to these two properties should be resubmitted to this office for review in accordance with the National Historic Preservation Act of 1966.

We understand that the project would require the demolition and replacement of the North Street Bridge. In the opinion of the State Historic Preservation Office, the proposed demolition of this property will have an adverse effect upon its historic and engineering character. We believe that the potential effect of the undertaking can be satisfactorily mitigated through the photographic documentation of the North Street Bridge in accordance with the standards of the Historic American Engineering Record.

We recommend that the U.S. Army Corps of Engineers request the early review of the Advisory Council on Historic Preservation (Attention: Ms. Margaret Orlup, Advisory Council on Historic Preservation, 1100 Pennsylvania Avenue, N.W. #809, Washington, DC 20004) in accordance with the National Historic Preservation Act of 1966.

We reaffirm our previous comment that the U.S. Army Corps of Engineers consider the University of Connecticut (Attention: Dr. Robert E. Dewar, Department of Anthropology, University of Connecticut, U-176, Storrs, Connecticut, 06268; telephone 203-486-2137) as a suitable repository for the professional curation and management of the artifactual data recovered as part of the field investigations for the project. In addition, we request that one additional copy of Raber Associates' archaeological survey report be provided to this office.

We anticipate working with the U.S. Army Corps of Engineers in the expeditious furtherance of the project as well as in ensuring the professional management of the state's cultural resources.

For further information, please contact David A. Poirier, Archaeologist.

Sincerely,

Dawn Maddox

Dawn Maddox
Deputy State Historic Preservation Officer

cc: Mr. Joseph Ignazio/COE
Mr. John Wilson/Corps of Engineer
Dr. Robert Dewer/UCONN

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J. F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

May 23, 1984

Joseph L. Ignazio, Chief
Planning Division
Impact Analysis Branch
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

Dear Mr. Ignazio:

We have reviewed the Public Notice Detailed Project Report and Environmental Assessment for the proposed plan of local flood protection along the Rippowam River in Stamford, Connecticut.

A few questions appear to remain unanswered in the report concerning provision of fish passage facilities at the Main Street Dam, sediment quality in Mill Pond which may be flushed downstream during the construction of the hinged section of the dam, and time of year restrictions for the construction in order to avoid interference with fish migration and spawning (May 1 - June 30). These questions were raised in the Fish and Wildlife Service letter to you dated May 4, 1984.

We understand from subsequent conversations with Susan Brown of your staff that:

(1) Construction will likely occur in low flow periods which will avoid the fish spawning/migration period. (We recommend a time of year restriction be included in contract specifications.)

(2) Your office will be contacting the state of Connecticut to discuss the potential for inclusion of fish passage facilities at the Dam. (Please keep us informed about this.)

(3) Mill Pond may have been annually dredged by the town and sediment movement from the Pond downstream will be controlled through the use of siltation curtains and cofferdam construction procedures. The

watershed upstream of the Dam is not industrialized and the sediments are probably clean. (If any data exists from the previous dredging projects, please provide us with a copy.)

Please call Edward Reiner of my staff at 617-223-3911 for further coordination on this project.

Sincerely yours,

William J. Butler

William J. Butler, Chief
Planning and Standards Section (WR/PS)

cc: USF&W, Concord, NH
NMFS, Milford, CT
CT DEP, Water Resources Unit

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Services Division
Habitat Protection Branch
14 Elm Street
Gloucester, MA 01930

May 24, 1984

Mr. Joseph Ignazio
Chief, Planning Division
New England Division
Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

Dear Mr. Ignazio:

The National Marine Fisheries Service (NMFS) has reviewed the information which accompanied your letter of April 27, 1984, regarding "Local Flood Protection: Detailed Project Report-Environmental Assessment for the Rippowan River at Stamford, Connecticut." The present proposal calls for modification of an 80 x 5 foot section of the 140 x 5 foot dam located 330 feet upriver from Main Street. The modification would include construction of a bottom hinged replacement section which could be lowered during flood events.

Two issues stand out as not receiving the depth of discussion they deserve in the information provided. The first is the potential for installing a fish ladder at the dam to allow a more complete use of the Rippowan River by diadromous fishery resources. Historically, these resources have used the entire river. Presently, however, they migrate only as far as the dam. Habitat requirements for diadromous resources are available and useable above the dam. Access over the dam would re-establish the use of the entire river for these resources. As a result of this we recommend that a permanent fish ladder be built into the portion of the dam which would remain rigid.

The second issue is the amount and character of the material which has collected in the pond behind the dam. Presently this area of Stamford is the site of a retail district, however, its historic use was industrial. Because of the area's historic use there is a potential for contaminants in the sediments. To alleviate this concern we suggest a bulk sediment analysis be performed prior to removal to check for possible contamination.

We have been informed that upland disposal is being contemplated for this project. Please keep us advised of any further development.

Sincerely,

for Bruce E. Higgins
Acting Branch Chief

CONSERVATIONISTS OF STAMFORD, Incorporated • P. O. Box 2012 – Stamford, Conn. 06906

May 30, 1984

Ms. Susan E. Brown
Impact Analysis Branch
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Mass. 02254

Dear Ms. Brown:

We have reviewed the draft of the Rippowam River Detailed Project Report including the enviromental assessment of the various flood control measures considered. We find these assessments to be apropriate, sensitively applied, and well taken. Good consideration was likewise given to the economic and practical factors of the various alternate proposals. As conservationists we are especially pleased that attention was directed to the enviroment.

We find that the two structural measures recommended (modify the main street dam and replace the north street bridge) when taken in conjunction with the very important five non structural measures (the implementation by Stamford of a flood forecast, warning, and emergency evacuation plan together with coordination with the owners of reservoirs to evaluate the potential for flood storage and control of future development in the flood plain) are practical approaches to the problem and should help mitigate the damage from flooding.

The measures suggested for the City of Stamford are extremely important, especially the flood storage potential, run off control, and the control of building in the flood plain. We hope our administration and land use Boards will take note and comply.

Your estimate of $26 million in damage from the next 100 year flood if the recommended structural changes are not made is significant. We note that the changes will reduce this cost by only $10 million to $16 million. The City of Stamford must take the responsibility to control and reduce this loss further. Could you not make attention to the non structural measures by the City a condition for receiving Federal money for the structural modifications?

Very truly yours,

R. A. Langenhan
Vice-President

RAL/li
cc: Mayor Serrani
Mark Lubbers
Florence Reissig

State of Connecticut

Department of Environmental Protection

State Office Building Hartford, Connecticut 06115

Stanley J. Pac
Commissioner

June 21, 1984

Mr. Joseph L. Ignazio
Chief, Planning Division
Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

RE: Proposed Local Flood Protection Project: Rippowam River, Stamford, Connecticut

Dear Mr. Ignazio:

In answer to your letter of April 27, 1984, I have asked my staff to review the draft Detailed Project Report and Environmental Assessment on Local Flood Protection for the Rippowam River in Stamford, CT. As a result of that review, I submit the following comments. These comments will also be relayed to the State's Office of Policy and Management in accordance with Executive Order 12372.

The recommended plan described in this project report is endorsed by my agency and is in keeping with state policy to seek non-structural solutions for floodplain management. Further, it minimizes disruption of riverine habitat. The state concurs with your planning process to date and recommends that you continue the design and project specifications stage. For your information, Section 69 through 98 of the Connecticut General Statutes (C.G.S.) require my agency to review and approve all flood control projects in Connecticut, whether or not the state contributes financially to the project. Although the State is not prepared to commit any funds to this project at this time, DEP has no objection to your seeking a letter of intent to cooperate from Stamford.

Please note that Section 26-136 C.G.S. directs my staff to evaluate the necessity of requiring a fishway as part of the repair, modification or new construction of dams. The purpose of this law is to aid in the restoration of fisheries to streams that can support migratory fish runs. As regards the timing of actual in-water constructions activities, mid-summer to the cooler months of the fall would be opportune for avoiding herring spawning season which ranges from March through mid-July

The Corps has evaluated a very wide range of alternatives for this flood protection project. I am pleased to see that you have incorporated non-structural techniques for floodplain management. My agency is actively involved in setting up a statewide flood forecasting - early warning system. Stamford is one of the first towns to initiate such a system at the local level. We

encourage this local cooperation and it is important and significant that you have incorporated it in your project planning.

In summary, DEP supports the recommended plan as one consistent with the state's long-term goals for floodplain management. Should you have any further information regarding this project, please contact Mr. Ben Warner, Director of my Water Resources Unit, (203) 566-7220. Thank you for this opportunity to comment.

Sincerely,

Stanley J. Pac

Stanley J. Pac

SJP/TSM/el

cc: Horace Brown, OPM

STATE OF CONNECTICUT

OFFICE OF POLICY AND MANAGEMENT
COMPREHENSIVE PLANNING DIVISION

June 27, 1984

Mr. Joseph L. Ignazio
Chief, Planning Division
Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02254

Subject: Environmental Assessment, Rippowam River, Stamford, CT

Dear Mr. Ignazio:

The Office of Policy and Management is the designated State Single Point of Contact in regard to intergovernmental review of federal financial assistance and direct federal development.

The above referenced environmental assessment was distributed in accordance with Connecticut Intergovernmental Review Procedures with the opportunity for review and comment. Enclosed are the comments and recommendations of the Department of Environmental Protection and the Office of the State Historic Preservation Officer which were the only ones received.

We appreciated the opportunity to provide comments concerning this proposed project.

Sincerely,

Gary E. King
Under Secretary

GEK:rdw

Enclosures
cc: Hon. Stanley J. Pac, DEP
Dawn Maddox, Historical Commission
David Fox, DEP

MAYOR
THOM SERRANI

429 ATLANTIC STREET
P.O. BOX 10152
STAMFORD, CT 06904-2152

CITY OF STAMFORD, CONNECTICUT

OFFICE OF THE MAYOR

August 29, 1984

Colonel Carl B. Sciple
Division Engineer
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02254

Re: Flood Control Project
Rippowam River
Stamford, Connecticut

Dear Colonel Sciple:

This letter provides the intent of the City of Stamford to meet items of local cooperation for the local protection project on the Rippowam River in Stamford, Connecticut. The proposed local flood protection plan will give much needed relief from future flooding in heavily urbanized sections of the city.

We are particularly interested in the improvement to the Mill Pond dam. The City's ability to replace the North Street Bridge referenced in paragraph (i) below is dependent on the receipt of State funding assistance under the Connecticut DOT Municipal Bridge Program authorized by Connecticut Public Act 84-254. We have initiated an application for funding and are advised that the State will make a preliminary decision on our application by early January 1985.

We understand that a formal declaration of local assurance will be required after the Detailed Project Report is approved by the Chief of Engineers. The exact amount of non-Federal contributions shall be determined by the Chief of Engineers prior to project implementation in accordance with the following requirements to which non-Federal interests must agree.

a. Provide without cost to the United States all lands, easements and right-of-way, including borrow areas and disposal areas for excavated material, determined suitable by the Chief of Engineers and necessary for implementation of the project;

b. Hold and save the United States free from damages due to the implementation and maintenance of the project, not including damages due to the fault or negligence of the United States or its contractors;

c. Maintain and operate project facilities after completion, in accordance with regulations prescribed by the Secretary of the Army;

d. At least annually inform affected interests regarding the limitations of the protection afforded by the project;

e. Publicize flood plain information in the area concerned and provide this information to zoning and other regulatory agencies for their guidance and leadership in preventing unwise future development in the flood plain and in adopting such regulations as may be necessary to insure compatibility between future development and protection levels provided by the project;

f. Prescribe and enforce regulations to prevent obstruction or encroachment in the project area which would reduce its flood-carrying capacity or hinder maintenance and operation, and control development in the project area to prevent undue increases in the flood damage potential;

g. Prescribe and enforce regulations to prevent modifications which would increase flows through existing bridges and culverts;

h. Insure an adequate evacuation plan through public education, testing and updating as required; and

i. Replace the existing North Street Bridge with a new structure which is equal in flow capacity to that of the recommended plan at no cost to the Federal Government.

My support for the project is based on the provisions of the existing cost sharing legislation as outlined in the Detailed Project Report. The City of Stamford is willing to consider other levels of cost sharing which are being considered by the administration or Congress in order to assure prompt completion of the project. I understand I have the opportunity to review cost sharing arrangements prior to commiting the City to a formal declaration of local assurances.

On behalf of the citizens of Stamford I thank you for your assistance to date, and I look forward to our continued co-operation to alleviate flooding in Stamford.

Sincerely,

Thom Serrani
Mayor

TS/scw

cc: Mark W. Lubbers
Peter Jackson
Commissioner O'Brien